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The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (Ed.).

FIRST PART.
ORIGINAL ARTICLES

Meteorology in Relation to Agriculture in Canada

by
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Director
and

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A systematic climatological survey of the Dominion has been the primary work of the Meteorological Service, and records of the weather covering periods ranging from a few years to 45 years are now existent in all the provinces. From these records mean values of the various factors of the weather such as temperature, rain and sunshine, have been deduced, and are available to agriculturists and others who may desire them.

A meteorological equipment has been placed at each of the Experimental Farms and the data which are being obtained by observers are daily of use to the farm in its usual activities, as well as to the student in agricultural meteorology.

From the earliest days of the Service, much thought and attention has been devoted to weather forecasts, which are disseminated in all the provinces of the Dominion. Contracts have been made with the various telegraph and telephone companies for the transmission of the forecasts to nearly every point reached by wire, and it only remains to arrange that the bulletins thus received at the telegraph office be disseminated more generally among the farming community and others living away from populous centres. Some progress has been made in this direction inasmuch as, at a large number of towns in Ontario, a copy of the daily forecast issued at the station, is delivered at the telephone exchange, and subscribers on rural farms have been informed that they can obtain the weather forecast by calling the central office; also in the Maritime Provinces, where the dissemination of the forecasts is as a general rule arranged by telephone, subscribers can easily obtain the forecasts.

It is probable, however, that it is through the press that the largest number of farmers obtain the forecasts; and this number is constantly augmented as the rural mail routes become more general.

The forecasts are issued twice daily — at 10 a. m. and 10 p. m. — are based on weather maps prepared from observations all over the continent two hours earlier. It is the 10 a. m. forecast which is disseminated most generally in the Dominion, but the 10 p. m. forecast is of high importance as it is this which appears in the morning newspapers in the province.

Many years ago arrangements were made with the railway companies whereby weather signals were carried on the baggage vans of trains. The experiment was not, however, wholly satisfactory, as there was difficulty in making the station agent see to it that the signal was changed from day to day in accordance with the forecasts, and trains would at times carry fine weather signal when it should have been bad. Another consideration in connexion with train signals and the use of flags, is the difficulty of conveying an idea of the coming weather by means of one signal. It is seldom in Canada that days are wholly rainy, and in summer especially there are very many days which are for the most part fine, but in which thunderstorms occur in some localities. The idea of such conditions may be conveyed with fair accuracy in several words, but with only one word it becomes a matter of uncertainty whether "fine" or "showers" will best suit the situation.

We believe that there is no section of the farming community which can be more profitably assisted by weather forecasts than the fruit grower, inasmuch as it is possible, in a large majority of instances, to predict with accuracy, or at least to inform the fruit grower that he should be on the *qui vive*, where the temperature is tending towards the freezing point.

It is certain that under existing arrangements any farmer in the more thickly populated portions of the country may by noon obtain the weather forecasts for the coming night and following day, and a strong endeavor will be made early in the next year to make it still more simple to obtain weather bulletins.

It is thoroughly recognized in the Meteorological Office that the duty of the meteorologist must be to forecast for a longer period than is at present possible, and indeed to outline the general character of coming seasons. With a vast accumulation of data and a period of experience covering several decades, the forecast officers of Canada, having made the attempt, must confess that generally speaking forecasts covering 48 hours are sufficiently accurate to warrant publicity. In nearly every season there are some periods when the movement of areas of high and low pressure is most erratic, and in some seasons the erratic movements are quite pronounced for long periods; it has been specially noticeable that severe storms and large temperature changes have seldom been foreseen many days in advance.

The writer is, however, confident that when variation in solar radiation is more fully understood and accurately measured, it will be found that careful correlation of this with the changes in the atmospheric distribution

globe, and the wind changes consequent therefrom, will provide the basis for determining seasonal variations in climate.

The channels through which the agriculturist may obtain a knowledge of the climate of his district are the Annual Climatological Report of the Service, the Monthly Weather Review, and the Monthly Weather Map. The *Review* of these gives summaries of the monthly and annual mean values of the meteorological station and tables of the monthly values of rain and snow. The *Monthly Review* gives mean values for the month, and a general picture of the weather conditions that have obtained. The *Map*, which is issued three days after the close of the month, shows the mean temperature of each of the provinces of the month just closed, the departures from the mean temperature, and the total precipitation, also in winter the amount of snow lying on the ground on the last day of the month. In the *Review* is given a general outline of the weather conditions and also a brief summary of crop reports obtained by telegraph through various agencies in the different provinces.

The agricultural section of the Meteorological Service, established in 1915, during the season of 1915, co-operated with the Dominion Experimental Farms System, in a field experiment on spring wheat in relation to weather, or meteorological environment. A plot of Marquis variety wheat at each of fourteen stations, distributed throughout Canada from the Atlantic to the west coasts. At every station regular daily records were, and will have been for a varying number of years, taken of precipitation, maximum and minimum temperatures, and bright sunshine.

The farmers recorded crop notes on a printed form, adapted from a model prepared from Russian. The questions called for a good deal of information, including: 1) general field conditions, and the farming methods employed; 2) dates of the important stages in the life of the wheat, from sowing to seeding, and the general condition of the plants at the time of the seeding; 3) average height of plants on the plot every seven days; 4) the damage done by adverse weather phenomena on plants and soil at any time during the season, and losses due to meteorological and to other factors; and 5) final yield and quality. After threshing time, the complete record was returned to the Central Office of the Meteorological Service, where weather and crop data are correlated.

Before an attempt at such correlation was made, every experimental station engaged in the co-operative work was visited and a knowledge of conditions, climatic and agricultural, obtained at first hand.

During the coming winter of 1915-16 all possible data will be recorded by the usual method, and by tables, and correlations of wheat and weather will be made, and cautious conclusions will be drawn.

The work is founded on the valuable precedent set by Russia in agricultural meteorology, and it is hoped to learn all that is possible about the climate from this Russian work from translations of publications in Russian for the past fifteen years. It is hoped, too, that equipment and methods will be perfected, so that a serious field attack may be made on the great problem presented in agricultural meteorology.

Fishing and Fish Culture in Hungary

by

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Species. Hungary has a very rich and varied fauna of fresh-water fishes; rich owing to the very favourable nature and temperature of the running and standing waters of the country; varied because the water courses being distributed between two seas include the most valuable species. Ichthyologists recognise 67 fresh-water species classified as follows:

I. TELEOSTEI

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|--|--|
| <p>** 1. <i>Perca fluviatilis</i> L.
 * 2. <i>Esox lucius</i> L.
 * 3. <i>Lutjanus bairdii</i> Cuv.
 * 4. <i>Aspius asotus</i> Cuv.
 ** 5. <i>A. pliocarpus</i> Cuv.
 6. <i>Acipenser baeri</i> L.
 7. <i>Acipenser schrenkii</i> Cuv.
 8. <i>Acipenser stellatus</i> Walb. Jordan
 9. <i>Cottus gibelio</i> L.
 10. <i>Cottus poecilopus</i> Heck.
 11. <i>Cottus bairdianus</i> Pall.
 12. <i>Ictalurus</i> Cuv.
 * 13. <i>Cyprinus carpio</i> L.
 ** 14. <i>Carassius auratus</i> Nil.
 * 15. <i>Carassius gibelio</i> Nil.
 ** 16. <i>Foxo vulgatus</i> Cuv.
 * 17. <i>Rutilus rutilus</i> Agass.
 18. <i>Barbus haasi</i> Heck.
 19. <i>Gobio fluviatilis</i> Cuv.
 20. <i>Gobio crummenanus</i> Agass.
 21. <i>Rhinichthys minckleyi</i> Agass.
 ** 22. <i>Alburnus alburnus</i> L.
 23. <i>Umbra carpio</i> L.
 24. <i>Phoxinus phoxinus</i> Heck.
 ** 25. <i>Abudefduhu</i> L.
 * 26. <i>Barbus haasi</i> Heck.
 27. <i>Barbus haasi</i> Heck.
 28. <i>Rutilus rutilus</i> Agass.
 ** 29. <i>Pelecanus vulgaris</i> L.
 30. <i>Pelecanus fluviatilis</i> Heck.
 31. <i>Pelecanus haasi</i> Heck.
 32. <i>Pelecanus fluviatilis</i> Heck.
 33. <i>Pelecanus fluviatilis</i> Heck.
 34. <i>Pelecanus fluviatilis</i> Heck.
 35. <i>Pelecanus fluviatilis</i> Heck.
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 66. <i>Pelecanus fluviatilis</i> Heck.
 67. <i>Pelecanus fluviatilis</i> Heck.</p> | <p>36. <i>Scardinius erythrophthalmus</i> L.
 37. <i>Lepomis niloticus</i> L.
 38. <i>Lepomis niloticus</i> L.
 39. <i>Squalius dolabula</i> L.
 40. <i>Teleostei agassizii</i> Heck.
 41. <i>Phoxinus lucis</i> Agass.
 ** 42. <i>Chondrostoma nasus</i> L.
 ** 43. <i>Cobitis fossilis</i> L.
 44. <i>Cobitis barbata</i> L.
 45. <i>Cobitis haasi</i> L.
 46. <i>Cobitis elongata</i> Heck.
 ** 47. <i>Esox lucius</i> L.
 48. <i>Umbra canina</i> Marsigli.
 ** 49. <i>Silurus glanis</i> L.
 50. <i>Amiurus nebulosus</i> Guntli.
 * 51. <i>Thymallus thymallus</i> Agass.
 * 52. <i>Salmo trutta</i> L.
 * 53. <i>Salmo trutta</i> L.
 * 54. <i>Trutta trutta</i> L.
 55. <i>Salmo trutta</i> W. Gibb.
 56. <i>Salmo trutta</i> L.
 57. <i>Alba pontica</i> Fischw. var. L.
 58. <i>Alba woodmanni</i> Ant.
 59. <i>Anguilla fluviatilis</i> Flem.
 60. <i>Anguilla fluviatilis</i> Flem.
 61. <i>Anguilla fluviatilis</i> Flem.
 62. <i>Anguilla fluviatilis</i> Flem.
 63. <i>Anguilla fluviatilis</i> Flem.
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 65. <i>Anguilla fluviatilis</i> Flem.
 66. <i>Anguilla fluviatilis</i> Flem.
 67. <i>Anguilla fluviatilis</i> Flem.</p> |
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II. GANOSTOMI

- | | |
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| <p>* 60. <i>Acipenser baeri</i> Heck.
 * 61. <i>Acipenser baeri</i> Heck.
 * 62. <i>Acipenser baeri</i> Heck.
 * 63. <i>Acipenser baeri</i> Heck.
 * 64. <i>Acipenser baeri</i> Heck.
 * 65. <i>Acipenser baeri</i> Heck.</p> | <p>60. <i>Petromyzon fluviatilis</i> L.
 61. <i>Petromyzon fluviatilis</i> L.
 62. <i>Petromyzon fluviatilis</i> L.
 63. <i>Petromyzon fluviatilis</i> L.
 64. <i>Petromyzon fluviatilis</i> L.
 65. <i>Petromyzon fluviatilis</i> L.</p> |
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III. CYCLOSTOMI

- | | |
|---|---|
| <p>60. <i>Petromyzon fluviatilis</i> L.
 61. <i>Petromyzon fluviatilis</i> L.
 62. <i>Petromyzon fluviatilis</i> L.
 63. <i>Petromyzon fluviatilis</i> L.
 64. <i>Petromyzon fluviatilis</i> L.
 65. <i>Petromyzon fluviatilis</i> L.</p> | <p>60. <i>Petromyzon fluviatilis</i> L.
 61. <i>Petromyzon fluviatilis</i> L.
 62. <i>Petromyzon fluviatilis</i> L.
 63. <i>Petromyzon fluviatilis</i> L.
 64. <i>Petromyzon fluviatilis</i> L.
 65. <i>Petromyzon fluviatilis</i> L.</p> |
|---|---|

* Species distinguished by the quality of their flesh.

** Species occurring in shoals or important as popular food.

species numbered 8, 50, 55, 56 have only been introduced recently by means of artificial breeding. Some fish-breeders are experimenting with other species of fish so that the above list will probably be extended. With regard to the multiplication of these species in the different water-courses, research shows that the more extensive the area of water the more numerous the fauna. Thus, the Danube comes first with 40 species, followed by the Tisza with 34, the Zagyva with 32, the Rába and the Körös with 28 species each. The smaller rivers count 14 to 19 species. Of the lakes, Lake Balaton carries 28 species and Velenceze only 11.

It should be pointed out that only about a third of the species mentioned in this list are used as food, whilst the rest are only of biological interest. From the market point of view the most important groups and species are *Salmonidae*; *Salmonidae*; *Lucioperca sandra*; *Silurus glanis*; *Esox lucius* and especially *Cyprinus carpio*; the species of allied genera, such as *Carassius auratus*, *Carassius vulgaris* and finally white fish of less value, but important from a quantitative point of view, are *Abramis brama*, *Acanthinopterygion volkmeri*, *Leuciscus rutilus* and *Pelecus cultratus*.

Summary.—Fish-culture in Hungary may be divided into three distinct periods: 1) abundance; 2) decadence; 3) renaissance.

As a source of food and as an occupation fishing has always taken a dominant part in the national life of Hungary. This is attributable to the extensive number of water courses as well as to the favourable natural conditions. The chief river is the Danube which waters a basin about 621 miles long. Along its course it receives the waters of the Tisza, its chief tributary, and of 27 rivers which together total a length of about 5,216 miles which in their turn are fed by about 600 smaller rivers and streams. In addition to these rivers, the country abounds in lakes, of which the chief are Lake Balaton (266.5 sq. miles), Lake Fertő (129 sq. miles), Lake Velenceze (50.5 sq. miles) etc. With regard to the mountain lakes there are 115 in the Carpathians alone. Hungary also abounds in fish ponds fed by the flow from the larger rivers into the plains. An idea of their extent is given by the 11,35.57 sq. miles of valuable arable land recovered by the construction of dykes and suitable drainage. These shallow flood-waters because of their warm temperature are very favourable to the reproduction of fish, so that in mid-summer when the waters begin to recede to their old beds they contain large numbers, and according to authentic statistics the stocks of fish in the rivers are sometimes increased by flooding. To such extent in favourable years that the Tisza is proverbially stated to contain "more fish than water".

The abundance of fish in the water courses of the plains has given rise to a flourishing fishing industry. Historical documents show that whole generations of families have lived entirely by fishing. The town of Szeged, for instance, was founded by fishermen and in the 15th century there were no less than 1,000 in that place; at Komárom the number of master fishermen numbered in the hundreds.

During the last century there still remained in the river districts flourishing corporations of fishermen, which constituted the richest elements

of the urban population. Even today the names of fishes and fishing occur in thousands of forms and variations in the names of localities and families. All these examples, which are capable of multiplication and testify to the former flourishing condition of the industry, indicate an enormous national consumption of fish.

In Hungary, as elsewhere, the extraordinary abundance of fish was only so long as the water courses remained in their primitive state. With the development of agriculture the conditions of life for fishes became less and more precarious, thus leading to the decadence of the industry, which coincided with the boom in agriculture. The farmers interested took the first steps in the construction of dykes against the floods and in the draining of the flooded lands. On the other hand, in the interests of navigation the State organised canalisation works and the regulation of the river beds. Apart from the enormous reduction of the fish lands (those in the valley of the Tisza were reduced to $\frac{1}{10}$ th of their former area) the two factors above mentioned have had the conditions of life of the fish are: 1) the prevention of the inundations which has deprived the fishes of their spawning places; 2) the enclosure of the river basins means that the flood waters, penned between the dykes, subside at a great rate and are the cause of a lowering of temperature unfavourable to reproduction. Amongst other causes completing the destructive effects of the above factors are: the erection of numerous locks along the river banks, river traffic, and poachers who in the absence of protective legislation have almost exterminated the fish. This has resulted in exorbitant prices for fish preventing its use in the towns, and the rapid diminution of the number of fishermen. Although these disastrous effects were resented throughout the country and the necessity of an immediate remedy was realised it was not until 1888 that the Government was able to check these depredations by the passing of the fishing law XIX of 1888, which came into force on May, 1, 1889. Since then the Hungarian fisheries have experienced a renaissance. Both State and private enterprises have followed a definite plan which has resulted in the development of the resources of the rivers to such an extent that already in some regions they are sufficient for the needs of the public.

Legislation. According to the terms of law XIX, 1888, the right of fishing is inseparable with ownership and belongs to the owner of the water or the river bank. The law also establishes a distinction between "closed" and "open" waters, the restrictions being only applied to the latter. In closed waters fishing may be practised unreservedly by those who have the right. Considered as closed waters are artificial ponds and waters surrounded by property belonging to one proprietor or divided amongst several, and not communicating with other fishing waters, so as to allow fishing from one to another. All other waters are considered as open waters. The authorities reserve the right to decide whether a water is open or closed.

The restrictions concerning fishing practice are identical with those established by legislation in other countries. Thus the method of fishing and the apparatus used are controlled. For the protection of fish (the economic value indicated above by asterisks) the law in question (1888)

ing of these species at a certain period and below a certain size, and forbids the sale of fish not having the legal dimensions.

The law, however, contains a provision regarding scientific fish breeding which anticipated the Bavarian fishing law by 20 years. This original and rational provision has compelled licensed fishermen to form an association for their common interest. The law also provided that in open waters fishing rights can only be exercised if the situation and area of the fishing are such as to allow-fishing in a rational manner without detriment to the interests of neighbouring land owners. In the absence of these conditions fishing rights cannot exist within the limits of the present law except in the hands of an association. The classification of waters for individual fishing purposes is made by the Ministry of Agriculture. In case individuals having fishing rights are unwilling to form an association where the association formed is not performing its duty the fishing right can be leased out by the authority for a period of six years, so long as it is possible to ensure the fishing being carried out in a manner beneficial to the public interest.

Undoubtedly this provision of the law has imposed very strong restrictions on the use of private property, but in return it should be recognised that it provides, from an economic point of view, a very valuable means of rational control; for, with the large number of owners of fishing rights, a small and intensive system of fish culture can only be realised by means of a compulsory association applying to all such. As in the case of common organisation, the associations can establish by vote, subject to the checks imposed by the statutes, the control, method and means of fish culture. These associations are called upon to produce a scheme which must be submitted for approval to the Ministry of Agriculture. On being approved this scheme must be adhered to under penalty of legal action and constitutes a basis on which the proprietors, as the most interested party, can manage a scheme of intensive cultivation, while in return, the State has the assurance that its financial dealings will not remain unprofitable. Finally, the compulsory approval of the breeding scheme enables the industry to be carried on in a uniform manner on any sized area of water and in a manner suitable to each species of fish according to the natural conditions of the water.

At first, the idea of an association was opposed by those interested, who saw in it a danger to their private rights. Later, however, when tangible results showed the value of fish-culture generally, the founding of associations began to gain ground. The increasing scope of these associations was due to the fact that whilst at first they were concerned only with the protection of the methods of fishing and questions concerning the protection of the unprotected fish, they gradually included the arrangement of leases and the suitable breaking up of leased lands, the adoption of a long term letting, and the realisation of a uniform method of culture, so that at the present time a rational system of breeding generally prevails. The result of this activity was the considerable increase in rents or the income from the value of fishing rights which has helped to shake the indiffer-

ence of the public towards the national fish-culture. In this manner there have been established 93 fishing associations representing an area of 65876 sq. miles of land carrying the most valuable fishing in the Hungarian plain. At present the organisation work is being carried on in the salmon districts of the mountain regions. With regard to the annual yield of public waters administered by the associations, no authentic figures are available. However the valuation calculated on the rents gives an approximate yield of 11 000 000 lbs. valued at over £100 000. These works of public value are supported by the State and the experts employed for the data necessary for organisation purposes, material for reproduction is supplied free, or financial aid being given to associations engaged in stocking. Where the suppression of poaching requires game keepers, the State contributes a certain fixed proportion to the expense of their maintenance.

Artificial Rearing. The provisions of the previous law only applied to open waters and thus the main lines along which the natural fisheries are conducted have already been traced. On similar lines artificial rearing has also begun to gain ground. Its utility being more direct and more certain it soon attracted attention and progressed more rapidly than the natural fisheries. As early as 1870 establishments were already in existence for trout breeding by means of artificial fertilisation. Although these plants still remain and have increased in number they have not acquired any great importance. The largest of these establishments maintains itself only by its egg production rather than by its fish. In contrast with this the practice of artificial incubation has increased in the management of public waters. At the present time there are 180 establishments for the artificial incubation of salmon spawn for the stocking of natural waters. The hatcheries, most of which are situated near streams, are of about 12 to 15 sq metres in area and consist of small wooden houses provided with incubators of the Californian and other types. The fry are placed in public waters in spring or even in autumn if the incubators are situated close to the breeding ponds. The staffs of the domainial forests (1) in particular give a great deal of care to fish breeding and are able to show well stocked trout rivers. In emulation of the example of these forest ranger-private breeders have also taken up artificial breeding with the effective support of the State which grants them the free use of the incubating apparatus, for 3 or 4 consecutive years, of salmon eggs also.

The fish breeding ponds are already much more important and have developed as an independent branch of production, the value of which has been realised by the agriculturists and added to their wealth. The breeding ponds provide a means of obtaining profits from barren lands and also a means of improving them. Up to the present this method of working has been adopted on wet pastures near water courses, but now ponds have been established on the alkaline lands of Alföld to improve their fertility. The results so far obtained have been so promising that an area of 2718 acres is being converted into a breeding pond.

The ponds are primarily destined for breeding of carp in connection with sandra breeding and sometimes also with the common silurus (*Silurus L.*) and the dwarf silurus (*Aminurus nebulosus* Günth.) and *Micropterus*. The last three only play an accessory part and constitute the smallest part of the mass of the essential species. Generally, fishing begins after 3 years but of late years fishing after 2 years has become common. Favourable conditions of soil and climate as well as the feeding enable fish of 2.2 to 3.3 lbs. to be obtained in 2 years, thus meeting the increasing demands to be met. The majority of the ponds are used for the artificial rearing of fish. Maize and barley are the chief feed, rye, beans, lupins and even meat meal and fish meal are also used. Satisfactory results have been obtained and this method of feeding is widely spreading.

Pisciculture in Hungary is an important factor in the increase of national wealth. This is shown by the fact that at the end of 1913 the intensification of the fish ponds was practised in 210 localities on an area of 30,000 acres of which about one half consists of artificial ponds with a discharge system and the other half of natural ponds which can only be partially improved up. The annual value of the products of these ponds exceeds 200 sterling. The Government encourages the formation of ponds and employs experts to make the plans and estimates, etc., and later to control the execution and working. It also favours the restocking of natural ponds by giving the necessary eggs and fry at the disposition of the communes and small holders, and supplies all information free. By this means the difficulties were overcome and success assured, so much so that big social concerns have taken up the industry. Thus, for the development of the vast area of water known as Lake Balaton, the Lake Balaton Fishing Company Ltd. was formed at Siofok in 1890 and for fish rearing on a large scale the Fish Rearers Society Ltd. was formed at Budapest.

State Institutions. — The Royal Hungarian Fishing Inspectorate established in 1883 at the Ministry of Agriculture is a bureau which has been acquiring technical capacity since the foundation of the fishing societies and that the working of the societies conforms to the law, orders, statutes, plans of working etc. It is also charged with supplying gratuitously to clubs and societies who make application to the Minister of Agriculture technical advice, local investigations, plans, the direction and supervision of works and the management of forests. The staff is composed of expert fishers assisted by master fishermen. These subalterns take a 3-year course of study at the Royal School of Water Masters, and complete their instruction by a practical course under the Inspectorate. They are then appointed to the control of works under execution and the management of fish ponds.

The Royal Station of Pisciculture and Water Purification of Budapest occupied with the theory and practice of fish and crayfish breeding. According to the rules of its organisation its work is as follows :

1. To determine the conditions of life of the fish and crayfish and the plants and animal organisms upon which they feed ;

2) the study of the rational feeding of fish and crayfish by means of systematic experiments;

3) the valuation and improvement of fish ponds;

4) researches on the poisonous effects of organic and inorganic matter on aquatic animals;

5) the determination of the cause and degree of mortality due to pollution of public waters;

6) the study of the methods and processes for the purification of foul waters from sewers and industrial works, the careful observing of the results obtained and to give advice and information to authorities and individuals on questions relating thereto;

7) the control of industrial firms so that they conform to the law regarding the purification of their polluted waters;

8) the study of the diseases of fish and crayfish caused by physical or chemical agents when appearing in an acute form.

The Station gives free information so far as its technical advice can be given without special examination. Its services are gratuitous in cases of public interest whilst in other cases a fixed charge is made the proceeds of which go to the Treasury. The staff consists of chemists and biologists.

The "Station of Piscicultural Pathology" which is a branch of the Royal Veterinary School works conjointly with the Institute of Pathological Anatomy. Its object is the study of fish hygiene, the spread of diseases, preventive measures and everything which may act injuriously to the multiplication and développement of fishes and crayfish. Diseases are examined gratuitously by the station.

Besides these institutions, the disinterested work of which constitutes a praiseworthy encouragement by the State, there is also the free distribution of eggs and fry by the State, the numbers of which distributed during the 10 years 1903 to 1913 are as follows: (in thousands).

Year	Eggs of <i>Lucioperca carpio</i> L.	Eggs of <i>Silurus glanis</i> Gibb.	Eggs of <i>Lucioperca sandra</i> Tur.	Fry of <i>Cyprinus carpio</i> L.	Total
1903	1,350	1,300	45,380	—	47,930
1904	1,870	1,310	50,000	—	53,180
1905	2,200	1,310	56,000	—	59,510
1906	2,200	1,500	56,000	336	59,936
1907	2,300	1,600	62,000	80	66,980
1908	2,500	1,780	61,000	90	65,370
1909	2,800	1,780	62,000	43.2	66,913.2
1910	2,700	1,750	61,000	700	66,150
1911	2,900	2,000	60,000	300	65,200
1912	3,000	2,000	70,000	70	75,070
1913	3,100	2,000	70,000	75	75,175

(Cf. also *R. Pêche*, 1915, No. 211.

It should be noted that this reproductive material was exclusively of origin.

In order to meet practical needs the Ministry of Agriculture publishes yearly a purely technical journal known as "Halászat" or "Fishing" which is issued gratuitously or at a very low price. In addition to that of technical knowledge this journal is published to rouse public interest and to direct the activities of those interested.

There are also bursaries of 300 crowns (about 12 guineas) given by State to fishermen who undertake practical studies with a view to increasing proficiency in pisciculture.

In completion of what has been cited above a summary of the State statistics for pisciculture is given for several years:

Years	kg
1929-1930	1,237
1931-1932	1,194
1933-1934	1,228
1934-1935	1,428

Mention should be made, as a private concern, of the "National Society of Pisciculture" at Budapest which deals successfully with all questions relating to fishing and the organisation of exhibitions.

Commerce. - It has only been possible to speak of a fish trade since reliable supply has been made available by the radical transformation of the industry. So long as the requirements of consumers were only satisfied by the products from natural waters the commercial movement was limited to a very limited number of markets in towns by the rivers. The best fish market in Hungary is Budapest whither some 40,000 tons of freshwater fish are sent annually.

The markets have no facilities for the storing of the produce, a fact which tends to a continual fluctuation in price. With the object of improving the conditions of sale of the artificially reared fish, the State encourages the establishment of reservirs at certain towns supplied with running water and capable of storing large quantities of fish. Already, in certain towns, neighbouring fish breeders are so organised as to be able to satisfy the requirements of the markets. Nevertheless the price still remains too high for the fish to attain its former popularity as a food. Although the country does not produce sufficient for national requirements a considerable amount is exported to Austria and Germany thus helping to maintain the high prices at home. In the writer's opinion these conditions justify the active intervention of the State more especially as nothing is being done for the creation of an important industry.

SECOND PART.
ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

147. **Biological Studies on the House Fly.** (1) ROSEVOLD, E., in *C. North. Rev.*
Medicine, Hygiene, Public Health, Bacteriology, LXXVIII, No. 18, pp. 618-620.
December 1, 1910.

The writer continues his studies on the housefly with the object of determining the constituents of horse dung favourable to the depositing of the eggs. He has shown that in the unmixed dung and urine soaked by it cattle, goats, pigs, rabbits and guinea pigs the eggs of the house fly do not appear to be deposited.

These excreta however may become suitable material for the development of flies after the addition of such a secondary fermenting substance as wheat bran. Thus feeding wheat bran to animals renders their dung liable to infestation with the larvae. Also mixing cow dung with horse manure as is frequently done in the country districts promotes the development of the larvae. The writer has already suggested a simple method of destroying the larvae of fresh horse dung by burying it in the centre of a mass of fermented dung. This method may be still further simplified if the fresh dung is removed from the stalls every day. In this case it only contains the eggs of the fly and these are easily killed at 40° C. by the heat of fermentation. It is sufficient to place this fresh manure in a hollow in the top of an old dung heap easily made by means of a rake. With this simple process the heat of fermentation rapidly extends to the fresh dung, thus sterilizing the eggs. Before each addition of fresh dung to the heap the surface of

the dung is raked together and placed in contact with the hotter dung along with the fresh dung. It is better to carry out these operations in the same day rather than the following morning, thus prevent the eggs from hatching during the night.

A Case of Septicæmia in Man produced by *Streptococcus equinus* in the Egyptian Sudan. — CHAMBERS, A. J. (Director Wellcome Tropical Research Laboratories, and DADDAD, GEORGE, in *The Journal of Tropical Medicine and Hygiene*, NATH, No. 23, pp. 295-296, London, December 1, 1915.

A fatal case of Septicæmia is recorded in a young Sudanese of 20 years, infected by *Streptococcus equinus* (described by Andrewes and Horder in 1907). Probably the infection took place from horse dung through a wound. *S. equinus* was obtained in pure culture from the venous blood of the victim.

This is the first record of *S. equinus* pathogenic in man and of its occurrence in tropical countries.

A Relative Score Method of Recording Comparisons of Plant Condition and other Unmeasured Characters. — FARR, E. F. (The John Hopkins University, Baltimore) *Plant World*, Vol. 18, No. 9, pp. 249-256, Baltimore, Md., September 1915.

The lack of means of expressing more or less quantitatively, relations which are not strictly commensurable, results in the adoption of a method of simple comparison which, though not involving serious error in the case of a limited number, becomes very troublesome and faulty when many things are to be considered or when non-simultaneous series are to be compared. Two methods are in vogue for avoiding these difficulties, viz.: 1) classification into "excellent, good, fair, poor, etc.;" 2) arranging the things in order of merit and assigning numerical values according to an arbitrary scale.

Both these methods suffer from the inherent difficulty of being dependent for accuracy upon the observer retaining constantly in mind the character and condition of all plants of the series at the same time. This is usually difficult but practically impossible when hundreds of plants are to be dealt with.

The writer has overcome this difficulty by the use of a method derived from that used by psychologists in the investigation of affections and which consists in the formalisation and partial quantitative expression of comparative judgments formed upon any criteria whatsoever.

The essence of the method consists in comparing the individuals of the series in pairs, recording the result of each comparison and the subsequent summation of the comparisons of each pair of individuals. The result is obtained a record of individual comparisons of each plant with each other plant and of the judgment formed in each case. This is reduced to quantitative terms by adding together the scores given to each plant in the course of the comparison.

The method may be illustrated as follows in which 8 plants are compared according to their general health and condition. Sixty-four squares are used on a sheet of paper, the numbers of the last seven plants being set

down in the upper margin and the numbers of the first seven in the left margin. Plant number 1 is then compared with plant number 2 as 1 is relative condition of all other plants in the series being neglected.

	2	3	4	5	6	7	8
1	1	3	4	5	6	7	8
2		3	4	5	6	7	8
			3	5	6	7	8
4				5	6	7	8
5					5	5	8
6						8	8
7							8

is judged that plant number 1 is better a figure 1 is placed in the square corresponding to plant number 1 on the left and plant number 2 on top. Proceeding the comparison of plant number 1 with plant number 3 leads to a judgement that number 3 is better and a number 3 is entered in the corresponding square. Similar comparisons of plant number 1 made with plants numbers 4, 5, 6, 7 and 8, after which a fresh series is made by comparing plant number 2 with each other plant. In this way 14 comparisons in made with each plant number. In case no direct detected a letter *a* is entered in the square thus counting as no score either plant. Adding up the scores we get the table on page 167.

A graph is then constructed by plotting these numbers as ordinates and the numbers of the plants as abscissae.

Small differences between individual plants can be taken into account by under-scoring or over-scoring the figures entered in each case and to each score a valuation ranging from 1 to 3 or 5 according to the score desired.

By means of this scheme the writer has been able to obtain comparisons of such diverse things as chemical precipitates, degree of flocculation of clay suspensions, relative ruggedness of mountain ranges, thickness of stand of vegetation, adhesiveness of wall-paper to different plaster-

			Year	Percentage humidity available at sowing time	Total rainfall in inches during growth period	Grain in bushels	Yield in bushels per acre
Late Autumn (Fallow)	1940-1943	V	1940	5.9	12.41	20.03	2.6
			1941	1.7	6.04	—	—
			1942	0.0	15.57	2.3	2.7
			1943	2.2	15.24	0.8	—
	Mean			4.7	12.32	5.0	—
Early Autumn (Fallow)	1940-1943	V	1940	7.2	12.41	27.8	3.5
			1941	3.8	6.04	0.3	—
			1942	2.7	15.57	13.8	1.7
			1943	3.1	15.24	2.3	—
	Mean			4.2	12.32	11.1	1.5
Summer (Fallow)	1940-1943	V	1940	10.8	12.41	42.5	4.5
			1941	0.2	6.04	2.6	—
			1942	5.5	15.57	20.2	2.7
			1943	0.8	15.24	10.3	1.3
	Mean			8.8	12.32	21.2	2.5

Considering the average results of the four years:

After cultivation at the end of autumn there was 2.7 per cent of available moisture at the period of sowing; after early autumn cultivation available moisture was 4.2 per cent and after fallow 8.8 per cent. With 2.7 per cent of available moisture the average yield was 5.0 bushels per acre; with 4.2 per cent it was 11.1 bushels per acre and with 8.8 per cent it was 21.2 bushels per acre.

The yield is therefore in direct relation with the quantity of moisture in the soil available at the time of sowing.

141. **The Frequency of Low Temperatures at Vercelli (Italy) and its Effect on Cultivation of Rice.** MARCARUTTI, B., in *Giornale di Risicoltura*, Year V, 1948, pp. 188-200; 1949, Vercelli, 1948.

The maximum temperature limits for the cultivation of rice are unknown in Italy whilst the minimum temperature limits are of great importance in the early stages of the rice crop. The resistance of the stems does not fall below 40° to 50 100 °C., and at lower temperatures the tender leaves and

the apical bud are partially arrested in growth according to the onset of the cold followed by a yellowing of the greener parts of the plants.

Observations on the growth rate of rice have shown that the maximum rate of growth does not correspond to the maximum temperature but rather to the highest minimum temperature associated with warm, short days.

Usually the highest minimum temperatures occur in July and the first half of August when the humidity of the air is relatively high and the days are very warm, so that the irrigation water prevents the morning temperature from falling below 50° F. During the last days of July and the first half of September of 1915 there was a considerable lowering of temperature in the Vercelli districts causing considerable damage to the rice crops. The majority of rices cultivated near Vercelli this period coincides with the most delicate and important stages in the growth of the plants, viz : development of the ear, inflorescence and grain. Some of the plants bore erect spikes with few lateral branches and without grain or only a few stunted diseased grain of a dirty white colour, showing that the first injury to the grain of rice due to a sudden lowering of temperature during development is a gradual decrease in all its functional activities, followed by arrest of growth and failure to mature. In the case of the inflorescence the effect is more obvious in the wrinkling of the glumes and atrophy of the organs of reproduction.

Since the probability of cold nights and sudden changes of temperature is very considerable at Vercelli towards the end of August and beginning September, late varieties cannot be grown without risk. Also in the case of Chinese rices it is desirable to choose early maturing varieties.

Influence of Growth of Cowpeas upon some Physical Chemical and Biological Properties of Soil. — LECLERC, A. Assistant Professor of Soils, University of Missouri. *Annals of Agricultural Research*, Vol. V, No. 10, pp. 170-171, Plate XI, Washington, December 1915.

SOIL PHYSICS
CHEMISTRY
AND
MICROBIOLOGY

Some authorities have expressed the belief that cowpeas are capable of exerting a loosening effect upon the soil, but no authentic data are available. These experiments were carried out at the Missouri Experiment Station to test this theory. The soil used was a silt loam. The point at issue was the study of the soil compactness and nitrate content of the plots in relation to various treatments. Five plots were used treated as follows :

- A. D. unploughed and kept clean.
- B. unploughed and planted with cowpeas.
- C. ploughed and planted with cowpeas.
- G. ploughed, artificially shaded and kept clean.
- H. ploughed, kept clean without either shade or cowpeas.

The artificial shade was erected on plot G, at a time when the cowpeas on B and F were matting over the soil. The shading device consisted of a piece of black chees-cloth stretched over a galvanised wire screen

supported by four legs. It was found sufficient to shade the soil by direct rays of the sun without unduly impeding the rain.

The compactness of the soil was determined by counting the number of times a weighted ram had to be dropped from a specified height so that a coned bin might be driven a given distance into the soil. These determinations were made for each plot and averaged. The results were checked by determination of the apparent specific gravity by Wiegman's method and the same ratio was found to hold in each case thus showing that the compactness devices are an accurate method of measuring soil friability. The average results for the relative compactness of the soil of the various treatments are as follows:

	H ₁ unploughed (bare)	H ₂ unploughed (cowpeas)	H ₃ ploughed (cowpeas)	H ₄ ploughed (artificial shade)
June 1 to 1 July 1	1.55	1.95	3.6	3.4
October 1 to 1 Nov. 1	1.64	15.4	4.9	5.9

Thus, the increase in compactness of the soil during the experiment was greatest on the unploughed plots and least on the ploughed plots with cowpeas.

Determination of the moisture content of the soils at different depths showed that more moisture was lost from the cowpea plots, but in the 3rd and 4th foot of soil, the surface soil of these contained more water than that of the uncropped plots. Plot H₂ (ploughed) showed the greatest loss of water from the surface soil. Comparing this with plot G (ploughed and shaded) which lost more water than plot H₂ it appears that the presence of moisture alone is sufficient to account for the permanence of the friability of the cropped plots.

Bacterial examination of the soil showed that the cropped plots contained greater numbers of bacteria than the uncropped plots, but no relation could be drawn from the determinations of the nitrifying and nitrifying efficiencies of the various plots.

It is concluded that the factors concerned in preventing the erosion of soil upon which cowpeas are grown are: 1. the bacterial activity and a greater production of active fungus, and 2. the mechanical effect of the crop in reducing the evaporation from the surface layers.

143 — **A Soil Sampler for Soil Bacteriologists**. Society of American Bacteriologists. Industrial Bacteriology. — NOYES, H. A. in *School of N. S.*, Vol. XLII, No. 3, p. 117. Leicester, Bul., 1918.

The object of this sampler is to furnish a piece of apparatus with which to sample the soil under one system of cultivation as well as under another. It also becomes the container for the soil after the sample is taken.

The sampler is a brass tube 11 inches long, with one end fitted

cutting edge. This cutting edge is so made that the soil is not appreciably compressed when the sample is taken. The end having the cutting edge is closed with a tight fitting brass cap two inches in height. The open end is plugged with absorbent cotton, makes the sampler complete. The mode of using this apparatus is as follows: Plug and cap as many samplers as desired to take samples of soil; sterilize them in the hot air sterilizer; take them to the field. Remove a cap from a sampler, insert the driving rod, remove the cotton plug and drive the sampler into the ground to the required depth, pull it out, flame and return the cap and the sample is ready for the laboratory.

The sampler has the following properties which are important in biological work: Easily sterilized; easily kept clean; easily monitored; durable.

The Effect of Phosphates and Sulphates on Soil Bacteria (Society of American Bacteriologists, V., *Industrial Bacteriology*,—FRED. F. B., in *Science*, N. S., Vol. XLII, 1915, pp. 317-318, Lancaster, Pa., 1915).

The influence of inorganic fertilizers on the bacterial processes of the soil has received much attention. For this reason a study of the influence of some of the pure salts of those elements which constitute an important part of commercial fertilizers was undertaken. The aim was to determine, if possible, the influence of phosphates and sulphates upon activities of soil bacteria and to ascertain if the fertilizing effect of these substances could be explained in part by the promotion of bacterial

The following methods were employed: Rate of ammonification in peptone and in soil; this was conducted with pure and with mixed cultures of bacteria. Aside from this, determination was made of the relation of bacterial cells to the amount of nitrogen ammonified. To show this, plate counts were used. The nitrogen for ammonification was in the solution in the form of peptone and to soil in the form of casein, a material which the nitrogen of these substances is converted into ammonia by distilling with magnesium oxide. The cultures were incubated at room temperature and at different intervals the amount of ammonia determined.

Monobasic potassium phosphate in peptone solution caused a great increase in the production of ammonia. This is noted with a pure culture of ammonifier and with a suspension of soil bacteria. The gain was noted at the end of the first two days. Merck's precipitated calcium phosphate caused a slight increase in ammonification, but not nearly so much as the monobasic potassium phosphate. Sulphates of calcium and magnesium increased ammonification to a small extent. The action of monobasic potassium phosphate was far greater than that of potassium sulphate. From this it seems that the potassium ion does not materially influence ammonification. The results of plate counts show that monobasic potassium phosphate causes an enormous increase in multiplication of bacteria. This is followed by a rise in ammonia. The ammoniac production, however, is not in proportion to the number of bacteria. This seems rather

to be a result of increase in the number of cells than increase in individual cell activity. All of the phosphates gave a large increase in the number of soil bacteria. There was only a slight increase from the sulphates. The same relative effect of phosphates and sulphates was noted in the carbon-dioxide evolution.

From the results of this work, as a whole, the following conclusion may be drawn: That possibly the increased crop production which results from the application of soluble phosphates is due in part to the stimulation of bacterial activity.

145. **Relation of Lime to Production of Nitrates and Mineral Nitrogen.**—SCALES, F. M. in: *American Bacteriologists*, V, Industrial Bacteriology). — SCALES, F. M. in: *N. S.*, Vol. XLII, No. 1076, p. 317, Lancaster, Pa., 1915.

The lime requirement of an acid soil was determined by adding a quantity of calcium carbonate to weighed portions of the soil, mixing and, after an hour, testing with litmus paper until a quantity was found which gave a neutral reaction. The lime requirement by the Veitch method was the same as the above. Fractions and multiples of this requirement were added to 100 gm. portions of soil which received in addition for one replicate set alfalfa powder. They were moistened with 18 per cent. of lead water and incubated for three weeks at 28° to 30° C. Determinations of nitrate and mineral nitrogen present in the samples showed that the living bacteria were most active in the presence of 50 per cent. of the calcium carbonate requirement and the ammonifying and nitrifying groups combined in the presence of 75 per cent. of the amount required according to the chemical determinations. In this particular soil an excess of calcium carbonate was markedly toxic for the nitrifying organisms and retarding for the ammonifiers.

146. **Methods of Soil Sterilisation for Plant Beds and Greenhouses.**—SHAW and HUMMELER, J. C. in *Ohio Agricultural Experiment Station, Circular No. 10*, p. 71, Wooster, Ohio January 15, 1915.

The writer describes three methods of soil sterilisation in use in Ohio State, *viz.*: 1. the perforated pipe method; 2. the inverted pan method; and 3. the formalin drench method.

The particular method in use varies according to the greenhouse conditions and type of soil used. Light soils and those rich in humus are more suitable to the pan method, the apparatus of which consists of a galvanised iron pan 6 × 10 feet and 6 inches deep inverted over the soil and heated with steam under pressure.

In the formalin method a 6 per cent solution of formalin (40 per cent. solution) is applied at the rate of 1 gallon per square foot and the soil stirred a few days to rid the soil of fumes poisonous to young plants. This method is the most expensive in actual cost of treatment, but less exacting in apparatus.

Green manuring in the Central Provinces, India. — ALLAN, R. G. (Principal, Agriculture College, Nagpur.) In *The Agricultural Journal of India*, Vol. XI, Part IV, pp. 385-392, Calcutta, October 1915.

The climate of the Central Provinces is characterised by a rainfall of 40 inches, compressed into the period between June 15 and September 15, the rains mostly beginning later and stopping earlier. Under these conditions the golden of green manuring is a very difficult one.

Plants used for this purpose are: Dhaincha (*Sisbania*), Sun (*Crotalaria*), Tarota (*Cassia occidentalis*), Bawchi (*Psoralea corylifolia*), *Leptochloa uniflora*, wild indigo (*Vernonia cinerea*).

In the case of paddy green manure generally precedes a winter crop, the most invariably wheat. In the case of paddy *sun* and *dhaincha* are the former having the advantage of a more rapid growth. Burying of green manure takes place just before transplanting. Experiments in 1911 to 1914 showed an average increase of 22½ lbs of grain per acre on the plots manured with *sun* and 20½ lbs for the *dhaincha* plots. If the monsoon arrives late the green manure crop suffers but no loss is obtained by postponing ploughing to a later date, late ploughing of the paddy being more serious than a decreased quantity of the manure.

Experiments on plots manured with artificials emphasised the value of phosphates and also of calcium cyanamide, in conjunction with *sun*. On irrigated plots the increase due to phosphates (flow dust) was increased from 14½ lbs. to 196 lbs per acre, and on the plots without irrigation the increase was raised from 14½ lbs. to 63½ lbs per acre owing to manuring with triple phosphate manure is best applied at the time of sowing the green manure crop.

Experiments on green manuring for the wheat crop carried out for a period of years have given results supporting the following conclusions: (1) The necessity of ploughing in the green manure is more important than the quantity of manure;

(2) Success is improbable unless at least 12 inches, or better, 16 inches of rain is received after ploughing in and before sowing. Ploughing should therefore be done by the first week in August, so that a quick crop like *sun* may be used or weeds collected on the field;

(3) When irrigation is available, either early sowing of the green crop is possible, or, if the rainfall falls below the minimum of 6 inches, irrigation should be applied before sowing the wheat to promote the decomposition of the manure.

(4) In areas where a rainfall of 12 inches after August 1st, cannot be obtained increased fertility can be obtained by feeding animals with a green crop during the monsoon. In this case the stubble should be ploughed by mid-August. A rainfall of 6 or 7 inches is sufficient after this time. Unless the increased fertility is essential a cultivated summer crop is probably a safer practice.

(5) In areas with a total monsoon rainfall less than 35 inches, green manuring for a winter crop is practically out of the question.

145. **Experiments in Java with Green Manures.** VAN BOLDEN, W. M. In *Mededeelingen van de Koninklijke Akademie van Wetenschappen, Afdeling Natuurkunde*, No. 2, 1914, pp. 1 plates and 2 Tables. Buitenzorg, 1915.

The writer describes a number of plants (amongst others, *L. candida*, *L. leoderiana* var. *anaena*, and *L. vogelii*; *Centrosema* sp.; *Citronia carinata*; *Desmodium gyroides*; *Indigofera hirsuta* and *L. hirsuta*, and *Crotalaria striata*) which gave excellent results when used as green manure in the Experiment Garden at Buitenzorg, especially the alang alang (*Imperata* sp.) and weeds had been previously uprooted.

The experiments carried out at the Experiment Garden of Batavia and in the plantations of Java brought out the following points:

Leprosia and *indigo* gave better results than the other plants as green manure, especially in the hevea, cacao and tea plantations.

Citronia carinata can be recommended as preventing erosion on bare ground.

Crotalaria rapidly covers the ground and produces alang alang foliage; it is to be recommended for young plantations of rubber trees and of tea shrubs, in order to prevent erosion and the spread of weeds.

Crotalaria has a subtrutescent habit and grows as well on the board as in the mountains.

The writer advises that the experiments should be continued with *Leprosia* sp., *Crotalaria maynissi*, *Desmodium hirsutum* and *L. hirsuta* by manuring crops other than those growing in the Batavia Experiment Garden.

146. **Experiments in Germany on the Effect of the Phosphoric Acid in Different Kinds of Basic Slag.** TACKER, G. In *Archiv für Landwirtschaftliche Pharmazie und Veterinärmedizin*, Vol. 11, No. 1, 1915, pp. 1-10, 1 plate and 1 table. October, 1915.

The very careful experiments made by the writers with different kinds of basic slag have proved that the effect of the slag is independent of the amount of fine particles contained and of the alkalinity, but in connection with the content of phosphoric acid soluble in water. Some slags, however, behave a little differently.

147. **The Relation of Sulphur to Soil Fertility.** SMITH, O. M. In *Kentucky Agricultural Experiment Station Bulletin*, No. 177, pp. 1-10. Lexington, Ky., Dec. 1914.

Numerous experiments have been made in the last few years emphasizing the importance of sulphur compounds in plant growth and its value in soil fertility.

The writer has determined the percentage of sulphur for a number of plants, and has found that several among these contain high amounts of this element. Among 31 varieties of tobacco only 10 contained less amounts of sulphur than of phosphorus, while the majority contained considerably more, the sulphur in some being about double the phosphorus. The average content of sulphur 0.458% and that of phosphorus 0.202%.

In order to determine the effect of sulphur on the growth of plants the writer has carried out a series of greenhouse experiments adding sulphur or its compounds to the soil. The first plant tested was

of tobacco, 250 seeds of which were planted in each of the pots with 15 lbs. of superficial soil taken from not very fertile soil containing 240 lbs. of sulphur and 800 lbs. of phosphorus per acre (assuming one acre of the soil, six inches deep, to weigh 1,500,000 lbs.; all the figures of the fertilizers are calculated on this basis). The order of the results are given in Table I. When the largest plants had reached the transplanting stage, all were cut close to the ground and immediately weighed.

TABLE I. — *Plan and results of the 1st series of experiments.*

Substance added per acre	Weight in grams of the cut parts of the plants
Nothing added	21
100 lbs. sulphur per acre	14
100 lbs. gypsum	5
100 lbs. gypsum containing 100 lbs. sulphur	4
100 lbs. potassium nitrate per acre	7
100 lbs. calcium phosphate (secondary) per acre	27
100 lbs. calcium carbonate per acre	4
Same as No. 5 + 100 lbs. sulphur per acre	26 (over check No. 5)
Same as No. 5 + 100 lbs. gypsum	24
Same as No. 5 + 100 lbs. gypsum	24

The addition of sulphur or gypsum in conjunction with the other elements and calcium carbonate, has evidently had for this soil a stimulating effect on the growth of the tobacco plants.

In a 2nd series of experiments the soil used was taken from poor ground containing 600 lbs. of sulphur and 300 lbs. of phosphorus per acre (assuming 12 inches of soil as weighing 2,000,000 lbs. per acre). The soil was mixed with calcium carbonate added at the rate of 4000 lbs. per acre. The substances added are given in Table II. Sixteen pounds of the air-dried soil thus prepared were put in two-gallon stone jars, 10 soy bean seeds were planted in each jar which were afterwards thinned to 6 average size plants. After the pods were matured, the plants were cut close to the ground, and weighed. The total sulphur and protein in the pods produced was also determined. After cutting the soy beans, the residue was put through a coarse sieve to remove the roots, and placed in the pots. In each pot 20 Purple Top turnip seeds were planted, which were afterwards thinned to 4 average size plants in each. When harvested the turnips, tops and roots, were weighed. The results of the 2 harvests are given in Table II. In several cases good results in the growth of soy beans were obtained with sulphur compounds,

TABLE II — *On-farm and results of laboratory series of experiments*

Name of material	Sulphate of lime per acre	Weight in lb. per acre	Percentage of sulphur	4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54		55		56		57		58		59		60		61		62		63		64		65		66		67		68		69		70		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86		87		88		89		90		91		92		93		94		95		96		97		98		99		100		101		102		103		104		105		106		107		108		109		110		111		112		113		114		115		116		117		118		119		120		121		122		123		124		125		126		127		128		129		130		131		132		133		134		135		136		137		138		139		140		141		142		143		144		145		146		147		148		149		150		151		152		153		154		155		156		157		158		159		160		161		162		163		164		165		166		167		168		169		170		171		172		173		174		175		176		177		178		179		180		181		182		183		184		185		186		187		188		189		190		191		192		193		194		195		196		197		198		199		200		201		202		203		204		205		206		207		208		209		210		211		212		213		214		215		216		217		218		219		220		221		222		223		224		225		226		227		228		229		230		231		232		233		234		235		236		237		238		239		240		241		242		243		244		245		246		247		248		249		250		251		252		253		254		255		256		257		258		259		260		261		262		263		264		265		266		267		268		269		270		271		272		273		274		275		276		277		278		279		280		281		282		283		284		285		286		287		288		289		290		291		292		293		294		295		296		297		298		299		300		301		302		303		304		305		306		307		308		309		310		311		312		313		314		315		316		317		318		319		320		321		322		323		324		325		326		327		328		329		330		331		332		333		334		335		336		337		338		339		340		341		342		343		344		345		346		347		348		349		350		351		352		353		354		355		356		357		358		359		360		361		362		363		364		365		366		367		368		369		370		371		372		373		374		375		376		377		378		379		380		381		382		383		384		385		386		387		388		389		390		391		392		393		394		395		396		397		398		399		400		401		402		403		404		405		406		407		408		409		410		411		412		413		414		415		416		417		418		419		420		421		422		423		424		425		426		427		428		429		430		431		432		433		434		435		436		437		438		439		440		441		442		443		444		445		446		447		448		449		450		451		452		453		454		455		456		457		458		459		460		461		462		463		464		465		466		467		468		469		470		471		472		473		474		475		476		477		478		479		480		481		482		483		484		485		486		487		488		489		490		491		492		493		494		495		496		497		498		499		500		501		502		503		504		505		506		507		508		509		510		511		512		513		514		515		516		517		518		519		520		521		522		523		524		525		526		527		528		529		530		531		532		533		534		535		536		537		538		539		540		541		542		543		544		545		546		547		548		549		550		551		552		553		554		555		556		557		558		559		560		561		562		563		564		565		566		567		568		569		570		571		572		573		574		575		576		577		578		579		580		581		582		583		584		585		586		587		588		589		590		591		592		593		594		595		596		597		598		599		600		601		602		603		604		605		606		607		608		609		610		611		612		613		614		615		616		617		618		619		620		621		622		623		624		625		626		627		628		629		630		631		632		633		634		635		636		637		638		639		640		641		642		643		644		645		646		647		648		649		650		651		652		653		654		655		656		657		658		659		660		661		662		663		664		665		666		667		668		669		670		671		672		673		674		675		676		677		678		679		680		681		682		683		684		685		686		687		688		689		690		691		692		693		694		695		696		697		698		699		700		701		702		703		704		705		706		707		708		709		710		711		712		713		714		715		716		717		718		719		720		721		722		723		724		725		726		727		728		729		730		731		732		733		734		735		736		737		738		739		740		741		742		743		744		745		746		747		748		749		750		751		752		753		754		755		756		757		758		759		760		761		762		763		764		765		766		767		768		769		770		771		772		773		774		775		776		777		778		779		780		781		782		783		784		785		786		787		788		789		790		791		792		793		794		795		796		797		798		799		800		801		802		803		804		805		806		807		808		809		810		811		812		813		814		815		816		817		818		819		820		821		822		823		824		825		826		827		828		829		830		831		832		833		834		835		836		837		838		839		840		841		842		843		844		845		846		847		848		849		850		851		852		853		854		855		856		857		858		859		860		861		862		863		864		865		866		867		868		869		870		871		872		873		874		875		876		877		878		879		880		881		882		883		884		885		886		887		888		889		890		891		892		893		894		895		896		897		898		899		900		901		902		903		904		905		906		907		908		909		910		911		912		913		914		915		916		917		918		919		920		921		922		923		924		925		926		927		928		929		930		931		932		933		934		935		936		937		938		939		940		941		942		943		944		945		946		947		948		949		950		951		952		953		954		955		956		957		958		959		960		961		962		963		964		965		966		967		968		969		970		971		972		973		974		975		976		977		978		979		980		981		982		983		984		985		986		987		988		989		990		991		992		993		994		995		996		997		998		999		1000	
				Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per 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acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of sulphur	Weight in lb. per acre	Percentage of 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obtained by the element sulphur were the best. The percentage of nitrogen has been increased in the soy beans which had sulphur compared but this is not the case for the percentage of protein. The percentage of the turnips was also considerably influenced by the sulphur.

was used in the 3rd. series of experiments on the effects of sulphates. The soil was taken from the same ground as that used for the 2nd. series. Calcium carbonate added to it at the rate of 4000 lbs. per acre. The substances added are give in Table III. In each jar were planted 100 clover seeds, which were afterwards thinned to 12 average size in each jar. Cuttings of the clover plants about one inch from the ground were made at intervals whenever the plant attained a height of about 10 cm. Four cuttings were made. The air-dried weights of these are given in Table III. The effects of sulphates on red clover gave no gain except in the case of potassium sulphate when the gain was probably due to the presence of potassium.

TABLE III. -- Order and results of the 3rd series of experiments.

Substance added in pounds per acre	Weight in grams of clover from 12 cuttings
Iron disulphide pyrites (1000 lbs.)	28.23
Ferrous sulphate (copperas) (500 lbs.)	29.60
" (500 lbs.)	30.14
Ammonium sulphate (500 lbs.)	28.05
" (500 lbs.)	29.60
Calcium sulphate (500 lbs.)	33.28
" (500 lbs.)	33.10
Potassium sulphate (500 lbs.)	39.42
" (500 lbs.)	30.03
Barium sulphate (500 lbs.)	27.50
" (500 lbs.)	29.19
Magnesium sulphate (500 lbs.)	31.14
" (500 lbs.)	31.15
Aluminium sulphate (500 lbs.)	30.89
" (500 lbs.)	28.05
Sodium sulphate (500 lbs.)	34.95
" (500 lbs.)	34.59
Thiosulphate (500 lbs.)	27.29
Flowers of sulphur (500 lbs.)	35.61
" (500 lbs.)	33.13
Nothing added but calcium carbonate	31.12
Control (500 lbs.)	31.59

TABLE IV.—*Chemical results of the pot-experiments.*

Number of plants	Name of substance	Weight of substance		Weight of residue		Weight of residue		Percentage of loss	
		Before	After	Before	After	Before	After	Before	After
1	Potassium sulphate	14.45	11	3.75	10.5	3	3	20	3
2	Iron sulphate	12.42	11	3.90	9	1.5	1.5	11.7	1.5
3	Potassium sulphate	13.16	13	2.35	28	1.5	1.5	11.2	1.5
4	Potassium sulphate	15.00	10	3.48	9	1.2	1.2	12.5	1.2
10	Iron sulphate	14.83	2	1.25	32	4	4	29	30
5 a	Stibic oxide	1.81	1	2.22	1	8	3	0	3
5 b	Potassium sulphate	15.17	18	1.30	14	18	12	12	37
6 a	Cupric sulphate	11.20	11	2.11	7	5	5	12	25
6 b	Potassium sulphate	16.86	16	1.80	20	6	4	28	50
7 a	Calcium sulphate	12.18	11	1.86	2	8	6	0	0
7 b	Potassium sulphate	10.11	10	1.45	2	2	2	7.5	7.5
8 a	Chronic sulphate	9.89	10	2.89	11	12	12	50	50
8 b	Potassium sulphate	12.05	10	1.62	11	3	3	12	62
9 a	Manganese sulphate	11.01	15	3.80	111	8	8	12	0
9 b	Potassium sulphate	11.02	14	2.69	17	11	15	37	87
10 a	Lithium sulphate	9.56	11	1.70	17	9	6	12	25
10 b	Potassium sulphate	9.01	12	1.15	37	10	6	25	25
11	Ammonium sulphocyanide	9.81	13	3.57	91	11	11	37	37
12	Potassium sulphate	15.72	18	6.88	32	8	8	50	0
13	Potassium sulphate	15.62	11	2.11	17	6	5	25	37
14	Flowers of sulfur	12.97	11	2.11	15	4	4	62	62
15	Potassium sulphate	13.61	17	2.72	49	16	23	100	187
16	Potassium sulphate	12.49	15	2.58	41	11	11	47	75
17	Potassium sulphate	7.37	10	3.17	23	11	11	25	25
18	Potassium sulphate	13.07	14	2.31	28	9	11	12	37
19	Potassium sulphate	22.62	18	3.82	10	10	10	12	37

A few seeds germinated but plants died.

In all the series of experiments the same type of soil was used adding the same amount of calcium carbonate. Besides the different sulphates, the sulphates were mixed with the corresponding carbonates or oxides, in order to determine to better determine the effect of the sulphur. The amount of sulphur added in its various compounds, was equivalent to 12 lbs. per acre. In each box were planted 50 Early Jersey Wakefield cabbage seeds, which after germinating were thinned to 25 average size plants. When the plants in the boxes had reached the transplanting stage, all were cut close to the ground. The plants were air-dried and weighed.

The soil was sifted and in each box 50 Giant Southern Curled mustard seeds were planted, which after germinating were thinned to 15 average size plants. After the best plants had commenced to bloom, all the plants were cut close to the ground, air-dried and weighed.

The same soil was employed a 3rd time for radishes. In each box were planted 20 Scarlet Globe radish seeds, which after germinating were thinned to 12 average size plants. The plants were gathered before they were fully matured and weighed. The results of this 3rd series of experiments are added to Table V.

The results obtained with *cabbage* show that only two sulphates proved beneficial. A few had no effect, while several were harmful to the plant.

In the case of *mustard*, several of the sulphates gave good gains over the checks and gave higher yields than their corresponding carbonates. In the case of *radishes*, the results were more irregular, but there is no doubt but that sulphur fertilization in some cases was beneficial.

Experiments were tried by the writer in growing *alfalfa* in sand cultures to determine the availability of the sulphur in its different compounds to the growth of this plant. Of the 38 substances used, the best results were obtained respectively with magnesium, ferric, sodium, potassium and calcium sulphates. Good results were also obtained with sulphur. In nine out of fifteen cases the sulphates gave better yields than their carbonates. Seven of the 38 substances used, were injurious to the growth of alfalfa and gave smaller yields than the checks.

Shortly after the addition of sulphur to the soil, after a period of about six months, that is after the plants have been cut down, the writer has determined the percentage of sulphate sulphur in relation to the total amount of sulphur, and has found that the sulphur is rapidly oxidized to sulphate, more so in fertile soil than in poor soil, and to a lesser extent with sand. When the soil contains a large amount of sulphur, it becomes acid in consequence of the oxidation of the sulphur, and if this acid is not neutralized by a base (calcium carbonate), it will be injurious to the growth of the plants, as is shown in Table IV for the pots numbered 20 and 21.

151. **A New Method Adopted in Russia for Studying the Root System of Cultivated Plants.** — KOVAL, V. D., in *Sel'dskokhozyaystvennaya Gazeta* (Agricultural Gazette No. 1), pp. 974-977, No. 16 (1907), pp. 999-1000. Petrograd, August and September, 1907.

The writer reviews the different methods adopted in studying the systems of cultivated plants (Orth, Dehérain, Heinrich, Müntz, de Romistroy, Sokolovskij), shows the difficulties connected with each of them, and draws attention to the fact that this study can only give effective results if it is prosecuted in the field and under the natural conditions of plant's growth.

The new method of studying the root system of cultivated plants has been worked out in Russia by the "Agronomical Section of the Bureau of Agricultural Machinery" attached to the Ministry of Agriculture, based on the principle of removing particles of soil by means of a current of air. Attention was first drawn to the possibility of applying this principle in the experiment field at Akimovka (Crimea). This is an experiment field belonging to the Bureau and frequently exposed to high winds; these winds reach the speed of 25 metres per second, and in unsheltered places often remove the upper strata of the soil, thus laying bare the roots.

After a series of laboratory experiments to determine whether it was possible to apply this principle, an apparatus called a "dust aspirator" was constructed according to the directions of the Agronomical Section. The choice of the name, however, was not a happy one, seeing that the apparatus not only removes soil particles by means of a current of air, but can also be used for other purposes, as for instance the analysis of the soil's texture, the determination of the state of the division of the soil by the separation of its particles by a current of air, etc. so that the apparatus may be said to be one of universal application. It has in fact been used in a variety of ways.

This apparatus is very simple; it consists of a motor of 4 H.P. borrowed from an automobile, and of a fan. The latter produces both pressure and suction draughts which can be directed towards any point. The experiments have chiefly been carried out on maize roots; a certain number of these plants have been obtained and the natural arrangement of roots in the soil has been registered.

The method of obtaining the roots in their natural surroundings in the field is as follows:

It includes 3 operations: 1) eliminating the soil particles by the aid of a pressure draught; 2) coordinating the positions occupied by the roots in the soil; 3) collecting the roots and making a plan of their vertical arrangement.

The 1st operation is effected thus: first there is placed around the plant to be studied an apparatus whereby the position of any point of the plant or its root system can be fixed in space. This apparatus consists of a square horizontal frame with a movable cross-bar furnished with a level and a plumb-line, is supported on 4 legs vertical and sunk in the soil. The exact position of the plant relative to the frame is then fixed by measuring 3 coordinates. After taking these measurements the apparatus is removed, but the stand is left in the ground, and then the

of the soil particles by means of a current of air. First the pressure is directed upon the collar of the plant, whence the soil particles are gradually removed until the beginning of the root system is reached. When this is attained the current of air is directed upon each root and the soil particles are removed till the root is completely exposed. The exposure of the roots is only effected easily and quickly when the ground has been previously prepared for the purpose, under natural conditions it requires considerable and certain auxiliary operations. In order to facilitate the detachment of the largest and most compact particles, a brush is most often used. The best plan, however, is to add a sufficient amount of water to the soil. The results of experiments have shown that this is about $\frac{2}{3}$ of the quantity needed for total imbibition) after which the particles are easily and quickly removed. In order to facilitate the exposure of the root system, it is important to make the soil damp up to a certain point, this can be effected without difficulty. If owing to the working of the apparatus, the roots are displaced from their natural position, they are fixed in the soil by means of a small kind of iron pin. Should the root break, the fragments must be joined together by means of a small tube of paper and the root must be fixed in the soil. Each root bears a number. If the work cannot be finished in one day, as often happens in the case of plants with a much developed root system, the exposed roots are covered with moist soil, in order to prevent desiccation and all the resulting complications.

The second operation consists in coordinating the positions occupied in the soil by the roots. It has been seen that after they have been laid bare, the roots are left and fixed in the position they actually occupied. The position of the roots in the horizontal and vertical plane is determined by means of the same apparatus which was used to fix the position of the plant. The position of the plant and the profile of the soil. For this purpose, the frame is attached to fixed feet, its horizontality is tested by means of a level and the position of each root is determined by measuring 3 coordinates. The measurements are made every 5 cm., and in less exact experiments, every 10 cm. of its length, and are inscribed beneath the respective number of the root. By means of these figures the arrangement of the root system in the soil can be transferred to a drawing, or the dried roots of the plant can be affixed to the paper in such a manner as to correspond with the inscribed figures. Further, to determine the arrangement in the horizontal plane, they can also be photographed from above. In order to determine the arrangement of the roots in the vertical plane it is necessary to draw, on the basis of the figures ascertained, the profile of the ground, the positions of the collar and roots of the plant, to inscribe the figures giving the distance of each point, and finally, to apply all the root system in such a way as to correspond with the drawing.

Without wishing to attribute a universal importance to the method described above, the writer nevertheless considers, that in researches relating to the effects of working the soil, its capillarity etc., it may render real service by throwing a light on a series of problems that have hitherto remained

152. — **The Vitality of Seeds passed by Cattle.** — MILNE, D. (Economic Botany). In *The Agricultural Journal of India*, Vol. X, Part IV, pp. 353-369. Calcutta, 1914.

These experiments were undertaken to determine whether wheat grains, fed to bullocks working in the wheat fields, would pass through the animals and retain their power of germination, thus becoming a source of impurity in pure culture plots.

Towards the end of January 1915, six bullocks were chosen, aged 14 years and pooled so that the dung from the various animals should be a mix. From the evening of January 21 until the evening of January 22, each bullock was given daily at 6 p.m. two seers (4 lbs.) of wheat grains previously soaked for one hour in cold water. At 10 p.m. uneaten grains were removed, air dried and weighed. The fodder consisting of green oat plants and wheat straw was also weighed. The dung collected in numbered baskets which were cleared every day at 7.30 a.m. at 6 p.m. Each day at 8 a.m. the dung was carefully washed and the wheat picked out for germination on sterilised sand covered with a 1/2 inch flannel.

The results are summarised as follows:

No. of bullock and age	Weight of wheat grain eaten by bullock in lbs.	Number of bullocks of wheat grains per lb.	Number of wheat grains eaten by bullock	Total number of wheat grains which produced at least 1 healthy plant after passing through animal
I. 14 years	10.25	11.400	119.550	23.096
II. 14 "	20.5	"	209.100	43.709
III. Over 14 years	5.0	"	57.000	5.572
IV. 11 years	20.0	"	228.000	25.036
V. 8 "	27.25	"	310.650	35.311
VI. 8 "	24.875	"	272.175	11.872

Wheat grains capable of germination appeared in the dung at 13 1/2 hours after the experiment began. Two or more days later the number of viable grains passed by a single bullock varied from 100 to 4,000 in a working day while the number passed in 24 hours reached up to 9,000. Wheat grains continued to appear in the faeces for two days after wheat had been excluded from the diet.

It follows therefore that uncrushed wheat grains fed either intentionally or accidentally to cattle working on pure culture wheat plots are a danger to the purity of those crops.

Seeds of gram (*Dolichos biflorus*) were also observed to pass through animal undigested but none were found able to germinate.

Viable seeds of the following were also found in the dung:

Aspeltis fistulosus.

Chenopodium album.

Lathyrus aphaca.

On the Cause of Albinism Due to Cold and Occurring in the Leaves of Uruguay Oats.

by ERICH BUCHHEIT, Botanical Institute, in *Beichte der Deutschen Botanischen Gesellschaft*, 1913, 8, pp. 475-479, Berlin, 1913.

The writer subjected the seeds of various species of cereals to different germination temperatures, in order to study the effect of the latter upon the growth of the plant. Germination took place in the dark and the seedlings were therefore completely yellow on account of want of chlorophyll cells.

At the end of some days, the young plants were placed in pots and brought into the light, when they soon assumed a bright green colour. Their growth was fairly normal.

In some species, however, Uruguay oats, manifested on germination an anomaly which has hitherto been little known. The leaves and stalks were not green, as in the case of other species, but wholly, or entirely, white. The writer, regarding this anomalous appearance had germinated at a lower temperature than the others, namely at $1-2^{\circ}\text{C}$. In the case of those plants of Uruguay oats which were not completely blanched, the white patches often disappeared under the influence of sunlight. When however, the leaves and stalks were entirely white the chlorophyll did not appear on the plants being brought into the light. All such plants continued to produce white leaves during no chlorophyll, finally died.

The writer has not yet determined the direct cause of this albinism, but is quite certain that the chief factor was the cold. It is very probable that low temperatures ($1-2^{\circ}\text{C}$) can injure the chloroplasts of seedlings during their vegetative cells. When the germination temperature is raised the plant develops normally for the first period, but is incapable of producing chlorophyll. As the latter substance is indispensable for assimilation, the plant dies after a certain time.

The writer also tried to determine whether the albinism he had observed was a hereditary character in Uruguay oats. For this purpose, he sowed the seeds of plants having partially white leaves and stalks. He obtained normal seedlings without white patches on either leaves or stalks.

The writer intends to continue these investigations.

The Question of the Toxicity of Distilled Water. — HUBBARD, R. P. (Michigan

State College) in *American Journal of Botany*, Vol II, No. 7, 389-401, Lancaster, Pa., 1915.

In studying the effect on organisms of single salts or mixtures of salts a control or check solution is necessary. Such solution should not cause any disturbance of the regular functions of the plant.

For this purpose distilled water has been used but recently the advantages of a physiologically balanced solution have been realised. Both methods have drawbacks; the latter because each organism demands a special balanced solution. The disadvantages of distilled water have been (1) to the leaching of salts from the roots; 2) to starvation of the plant; 3) disorganisation of certain complex compounds in the root system; 4) to the occurrence of a toxic substance derived from the apparatus.

The writer investigated the toxicity of distilled water using seedlings in distilled water and various mixtures of distilled and tap water.

He concludes that the harmfulness of distilled water is not due to any one predominant factor, but rather to a resultant of many.

Firstly, there is the question of the adjustment of the tissues to growth was obtained when the change from tap to distilled water was gradual then when made suddenly.

Secondly, there is the question of root excretions. Roots growing continuously in distilled water presented the appearance of roots in very dilute solutions of toxic salts. No toxin was isolated from the tap water, but changing the water four times daily greatly increased the growth of the roots.

157. **Water as a Factor of Production in Leguminosae** (Royal Hungarian Agricultural Experiment Station at Mennyasszony). — HERKE, S., in *Köszönetnyilvánítás a Magyarországi Mezőgazdasági Kutatóintézetek részéről a Magyarországi Mezőgazdasági Kutatóintézetek részére*, Vol. XVIII, Part 1, pp. 76-85. Budapest, 1915.

According to the latest researches, the development of plants depends on the absorption of nutritive substances and the amount of the crop stands in a mathematical relation to the variation in the factors of production. However, however, each factor acts in a different way upon the development of a plant, there is also a difference in the relation between each factor of production and the amount of the harvest. There is a certain combination of factors which gives the best results, but if, for example one of them undergoes a disturbance in this balance (undergoes a change in the course of growth) the relation between the variation of another factor and the amount of the harvest also undergoes a modification, all else being equal.

During the last 20 years, Seelhorst and his pupils in the first place, and more recently, Pfeiffer, Blanck and Mitscherlich have systematically studied the part played by water as a factor of plant production. Their experiments have confirmed the existence of a certain relation between the amount of the crop and the increasing amount of the water supplied. According to the experiments of Mitscherlich, Pfeiffer and Blanck, the maximum yields of wheat, oats, peas and potatoes can be obtained with a volume of water corresponding to 100, 70, 90 per cent of the water absorption capacity of the soil.

With a view to determining the influence exerted by water on the development and yield of leguminosae, and on the increase of nitrogen in the soil in which they are cultivated, the Royal Hungarian Station of Agricultural Experiments undertook some experiments in 1913 and entrusted carrying out to the writer. The experiments were made in painted earthenware pots each containing in one series, 44 lbs of sandy, slightly calcareous soil, and in the other series, 39.6 lbs of clay containing much lime. The subjects of the experiments were: *Lupinus albus*, *Ornithopus sativus*, *Psoralea arvensis* and *Vicia faba*. In each pot were planted 48 seeds of *Lupinus albus*, 48 seeds of *Psoralea arvensis* and 48 seeds of *Vicia faba* and 5 × 48 seeds of *Ornithopus sativus*. After the seeds had germinated, 30 stems of the first three plants and 10 stems of the fourth were left in each pot. The plants extracted were

of the respective pots. All the four kinds of plants were sown in the same kind of soil on May 15 and harvested on August 13. From the time of sowing, they were supplied with water in the following manner; 6 pots of each kind of plants growing in each kind of soil received an amount of water corresponding to about 30 per cent of the absorption capacity of the soil, 6 pots received an amount corresponding to about 90 per cent of the said capacity. In order to simplify matters, the writer called the first volume of water "not plentiful," and the second "plentiful".

From these experiments, of which the results are shown by photographs and summarised in numerous tables, the writer draws the following conclusions:

"In the case of the Leguminosae, water plays an important part. "Plentiful water" increased the crop much more than "not plentiful", the effect upon the different plants is not the same, it also depends on the nature of the soil. On slightly calcareous, sandy soil, "plentiful water" considerably increased the yield in dry matter of all four plants, namely 30 per cent in the case of *Lupinus albus*, 26 per cent in that of *Ornithopus sativus*, 50 per cent in that of *Pisum arvense* and 25 per cent in *Vicia faba*. On very calcareous clay, "plentiful water" decreased the yield of *Lupinus albus* 31 per cent, while it increased the crop of *Ornithopus sativus* 4 per cent and the crops of *Pisum arvense* and *Vicia faba* 130 per cent and 88 per cent respectively. In the case of "plentiful water" the injurious effect of the lime upon *Lupinus albus* was much more noticeable than in the presence of "not plentiful water". In comparison with "not plentiful water", "plentiful water" has an almost equal effect upon the root yield, but less upon the green portions of the plant.

"Plentiful water" diminished the nitrogen percentage of the green parts in a more noticeable manner in the case of *Lupinus albus* and *Ornithopus sativus* than in that of *Pisum arvense*, or *Vicia faba*. On the other hand, it did not alter the nitrogen percentage of the roots. Water promoted the formation of nodules; with "abundant water", especially in the cases of *Pisum arvense* and *Vicia faba*, many more nodules were formed upon the roots than with "not plentiful water".

The water also had a material effect upon the reserve of nitrogen. With "plentiful water", the nitrogen percentage of the two soils in the case of the green plants was higher than with "not plentiful water".

At the time of harvest, the total amount of nitrogen (soil nitrogen + plant nitrogen) was greater in the case of one of the pots receiving "plentiful water" than in that of one supplied with an amount not exceeding 30 per cent of the water that the soil was capable of absorbing. The greatest difference in nitrogen content was observed in *Pisum arvense* and *Vicia faba*.

Contributions to the Physiology of Stomata in *Saccharum officinarum* L. Observations on Transpiration in Sugarcane. — KUYPER, J. in *Archief voor de Landbouw- en Tuinbouw-industrie in Nederlandsch Indie*, Year XXIII No. 44, pp. 197; 1200 and No. 45, pp. 1135-1733, Srarabaja, November 1915.

Following his work on the structure of stomata (*Archief*, vol. 22, 1914, p. 1070) the author now made investigations about the way in which

stomata are affected by light, temperature, and humidity. The results are published in the first pamphlet. In the introduction a short survey is given of the new literature on the subject; special attention is paid to the new American investigators as Briggs, Shantz, Livingston, Cannon, Shreve and the work of Prof. O. Renner.

Chapter I deals with the method and its application. After various trials with other methods, the author decided to use only the oil-kerosine-oil-benzin test, first introduced by E. Stein. The opening of stomata is estimated by the rate of rapidity with which these several agents penetrate into the leaf tissue. Several hints are given of peculiarities found in its application.

The influence of light and temperature on the opening of stomata is the question dealt with in the following chapter. Direct sunlight shows itself a very active agent for opening the stomata; darkness prevents from opening, and causes closure when the leaf was open before. It seems that prolonged darkness so operates, that the stomata open to a constant but very low degree. When there is a moderate opening of light e.g. from a clouded sky, the stomata open slowly, generally not to such a degree as in strong sunshine; this is one of the reasons why sunny mornings are a great profit for cane cultivation. In measuring the influence of darkness a big dark chamber was used, made from bamboo, which made it possible to work with 6-month old plants in the field.

However, the dark cloth absorbed such a quantity of warmth from tropical sunbeams that the temperature rose to about 43° - 45° C., the result of which was, that instead of closing of stomata by darkness, only by heat resulted. When a shelter against the sun was made over the black room the temperature remained normal and then darkness caused closure of stomata as usual.

Only a few experiments were made on air humidity; the stomata seem to be more opened by a high relative humidity than by a low one. In the field however a high humidity of the air is almost always connected with rain, and is the result of a high soil humidity owing to rainfall or irrigation. In consequence the plant is saturated with water. The higher the saturation the wider is the opening of stomata and the longer the stomata remain open under unfavourable conditions. So it is difficult to determine the specific influence of a high content of water in the air.

In another chapter several varieties of cane are compared as to their diurnal behaviour of stomata. In every variety the rate of opening after sunrise is smaller than that after midday; however, it is not the same in all varieties; that a difference consisted as to the hour at which closing began. Moreover, in one variety the difference between maximum and minimum opening is much greater than in another. One gets the impression that the closing is a profitable feature for the plant; that the water consumption of such a plant is more economical than in others. As to the question of daily periodicity the writer concludes that many facts may be explained by the influence of light, temperature and water-content, but still many

indications that after a prolonged period of darkness the stomata try to open themselves during the time from 8 to 10 in the morning, which may be considered to point in the direction of periodicity.

The second article gives an account of transpiration experiments in connection with the movement of stomata. To get an idea of the rate of transpiration during the period of rapid development of the cane, 6-9-months old stalks were used; they were cut in the early morning, placed in bottles in which the water was covered with some oil. The bottles were protected from abnormal temperatures by a cover of rough pottery. The loss in weight (often to an amount of 700 grams one day) was used as a measure for transpiration.

The author thinks it much better to use this method than the weighing of potted plants. When using potted plants one will get quite other results, as the quantity of available water changes accidentally. By watering abundantly the loss in weight increased to twice the amount of the original. Fresh stalks were used every day. In the stomatal investigations it has been mentioned already that differences existed between varieties as to the moment when closing began; the same fact was noted in transpiration. Some varieties showed their maximum rate for transpiration in the early morning whilst the loss in weight gradually decreased; other ones had a maximum at 11 o'clock and still other ones showed their maximum differences during the whole day. So one may distinguish three types which differ in the way they use the available water; their behaviour differs as to the cane production and their consistency against frost. The daily loss in weight may be in one variety twice as great as in another.

The connection could be demonstrated between the number of stomata per unit of leaf area and transpiration.

The maximum of transpiration may be reached after the closing of the stomata has begun; the rate of transpiration is to a certain extent independent of the behaviour of the stomata.

Darkness or weak light is followed by a decrease of the transpiration rate.

The results about the number of stomata and the loss in weight by transpiration are given in the original publication.

The most important result of these investigations is the different results which several varieties show in the rate of transpiration; it produces a new principle for the selection of canes for certain conditions of soil and climate.

12. Influence of Temperature on Respiration in Fruit. — ZEREVNIKOV, E. V. and V. A. BUKH, D. L. (Laboratory of Commercial Food Stuffs of the Commercial Institute, 1934, *Chelobitovoe Delo* (Cold Storage Industry), No. 67, pp. 272-282, Moscow, 1934, 144 pp.).

After living fruits after harvest complex enzymatic processes continue, the most important of which is that of respiration. This process concerns chiefly the starch, fructose, glucose and saccharose. Oil occurs in such small quantities that it has a negligible influence on respiration and starch is usually ab-

sent from ripe fruits except in the case of bananas which contain as much as 14 per cent.

Respiration of plants occurs normally in the presence of oxygen; in its absence or when present in less quantities than 2 per cent intracellular respiration occurs resulting in the decomposition of sugars with the evolution of carbon dioxide and alcohol. Like all other vital processes, respiration is dependent upon external conditions, of which temperature is particularly important.

In 1914-15 the writers made experiments on the influence of temperature on respiration in the following fruits: apples ("Antonowka", "Crimean Chafran"); pears ("Royal"); grapes; oranges (California) and Italian lemons, using a special apparatus for the purpose.

The results of these experiments are as follows:

<i>Apple</i>		<i>Grapes</i>	
Temperature	Loss of weight in gms. of CO ₂ per kilogram of fruit	Temperature	Loss of weight of CO ₂ per kilogram of fruit
0.4°	0.0046	— 0.16°	0.0008
7.8°	0.0131	7.0°	0.0010
13.2°	0.0235	11.7°	0.0027
		25.2°	0.0042
<i>Apple</i>		<i>Oranges (California)</i>	
0°	0.0037	— 0.2°	0.0008
4°	0.0070	7°	0.0010
7.8°	0.0112	13.5°	0.0021
13.4°	0.0170	18°	0.0032
<i>Pears</i>		<i>Italian lemons</i>	
— 0.4°	0.0009	— 4°	0.0008
8°	0.0071	0.5°	0.0010
8°	0.0104	7°	0.0010
13°	0.0141	10°	0.0021
14.1°	0.0200	15°	0.0040

Thus showing that respiration increases with increase of temperature. As a general rule a rise of 1° C. increases the yield of carbon dioxide per gram of fruit per hour by 1 milligram; the minimum being 0.8 mg. in the case of lemons and the maximum 1.2 mg. in the case of the apple "novka". Generally the output in carbon dioxide increases more than the increase of temperature.

The most important constituents of the fruit are consumed, organic acids and sugars. Thus by storing fruits at low temperature consumption of organic matter is very much reduced. At a temperature of 7° C. apples lose 3 times as much carbon dioxide as at 0° C.; and pears 5 times as much; oranges 7 times and lemons 5 times. While at 15° apples lose 5 times as much, pears 8, grapes 11, oranges 8 and lemons 8 times as much as when stored at 0°.

assuming that all the carbon dioxide is derived by the oxidation of sucrose. The writers calculate this loss as follows: at 0°, from 0.07 to 0.10 per cent, at 15° from 0.34 to 0.64 per cent, at 15° from 0.71 to 1.16 per cent per hour.

Some **Effects of Ethylene on the Metabolism of Plants** (1). — HARVEY, E. M. (Botanical Laboratory) in *the Botanical Gazette*, Vol. LX, No. 3, pp. 193-214, University of Chicago, Ill. September 1915.

Selected sweet pea seedlings were exposed in an atmosphere containing 1 per cent by volume of ethylene. The effects of the treatment were investigated under the following heads: 1) chemical composition, 2) osmotic pressure and permeability and 4) respiration.

The results were as follows:

1. The simple soluble substances increased at the expense of the insoluble and insoluble forms.

2. The hot alcohol-ether soluble substances (sugars, amino acids, polypeptides, lipoids, etc.) increased by 8.9 per cent, while the insoluble substances (proteins, starch, cellulose, ligno-celluloses, etc.) were correspondingly diminished. The water content of the ethylene treated control tissues was the same.

3. The soluble lower sugars (by direct reduction) were about 11 per cent more and the soluble higher sugars (by reduction after hydrolysis) 10 per cent less; the cellulose content was also diminished by about 10 per cent.

4. Amino acids and amides were increased and the polypeptides greatly decreased; the protein content was also about 3 per cent less.

5. Fats were much less abundant but the free fatty acid value was increased.

6. No change in acidity was observed.

7. The osmotic pressure as determined by both freezing point and dialytic methods was increased.

8. The CO₂ production and O₂ absorption were retarded, but the ratio remained practically the same.

On the Inheritance of Some Characters in Wheat. II. — HOWARD, A. and HOWARD, L. C. (Imperial Economic Botanists) in *Memoirs of the Department of Agriculture in India, Botanical Series* Vol. VII, No. 8, pp. 273-285, Plates I-VIII Calcutta, October 1915.

In a previous paper (2) it was shown that F₂ generation hybrids between bearded and beardless ears of wheat were intermediate in type. The explanation of these results appeared to be that two factors are present in the bearded parent, one capable of producing short awns or tips. The other when added to this resulting in fully bearded plants.

On the presence and absence hypothesis the results of the various crosses would be represented as follows (B representing the long and T short factor):

¹ Also *B.* Feb. 1914, No. 113, and *B.* Oct. 1915, No. 1089. (Ed.)

² *B.* Feb. 1913, No. 118. (Ed.)

1. Fully bearded wheat = BBTT.
2. Plants with tips only = bbTT.
3. Absolutely beardless plants = BBtt.
4. The F_1 generation between 1 and 2 = BbTt.
5. The F_2 generation = BBTT + 2BbTT + 2BBtt + 4BbTt + BBtt + bbTT + 4bbTt + bbtt.

In order to test this theory and isolate if possible the two factors, a cross between a fully bearded wheat and an absolutely beardless wheat was continued to the 4th generation.

Out of 247 F_2 plants, 230 ripened enough seed for sowing. Of 230 mature plants 1 was fully bearded, 2 half bearded and 14 were tipped.

The results of the F_2 generation of a cross between a fully bearded and beardless are summarised as follows :

	Fully bearded	Half bearded	Short tipped	Half bearded tipped	Long tipped	Minute tips	Short tips	Minute tips
	BBTT	BbTT	bbTT	BbTt	Bbtt	BBtt	Bbtt	bbtt
Expectation	1/16	2/16	1/16	4/16	2/16	1/16	2/16	1/16
Actual	1	2	1	4	2	1	2	1

Four of these types, viz. fully bearded, BBTT, beardless, bbtt, tipped, BBtt, and short tipped, bbTT, bred true in the F_3 generation.

Crossing the two latter types gave an F_1 generation exactly as in the F_1 between the original parents and having the constitution BbTt. The F_2 generation of this cross showed all stages between beardless and fully bearded. The theory is therefore confirmed.

The isolation of the two constituents of the fully bearded wheat may prove of some practical value in India where there is in certain localities a preference for awned wheats which suffer less from attacks of rust and hold their grain better. By the selection of suitable types with short or long tips it might be possible to meet the prejudices of the cultivator while avoiding the main disadvantages of long awns.

The inheritance of felted and smooth chaff characters was further investigated and results similar to the above were obtained showing the same factors are involved in the felted character. Cases of felting were observed in which only one character was involved. This factor is of considerable importance in the damper regions of India as it increases the tendency to lodge and the spread of rust, etc.

166. The Relation Between the Sugar Content and the Chemical Characters of the Descendants of the Same Plant of Sugar Beet in the 1st Generation.

K. M. H. BERNARD, *Journal of Agricultural Science, Cambridge*, Vol. 40, No. 1, 1928, pp. 1-10. (Received 12.12.1928.)

In their latest experiments the writers proposed to determine

- a) The relation between the weight of the root and its sugar content on the one hand, and the relation between the weight of the leaves and the sugar content of the root on the other ; b) the relation between the amount of sugar and of dry matter in the leaves and roots ; the relation between the sugar content and the amount of ash in the roots and leaves ; c) the relation between the sugar and albumen contents of the roots and leaves.

The results of the experiments may be summarised as follows:

1. The descendants having the same saccharine content may vary in weight of their roots and leaves, but these differences do not exceed a certain limit of variation. As regards the average sugar content and the average weight of the roots, the law of correlation has but a limited importance; the importance of this law is greater in the case of the average weight of sugar in the roots and the weight of the leaves. As to the last point it may be said that the larger the saccharine content of the roots, the larger the average weight of the leaves.

2. The descendants having the same saccharine content may have different amounts of dry matter present in their roots and leaves, but these differences are within the normal limits for dry matter. As a rule, the smaller the amount of sugar, the less dry matter there is in the root and leaf.

3. Plants with the same saccharine content can have different amounts of ash in their roots and leaves, but these differences are always within the normal limit of variation. Generally, a larger amount of ash in the roots and leaves also corresponds to a higher sugar content in the roots and leaves.

4. Plants with a determined sugar content may have different amounts of nitrogen in their roots and leaves, but these differences do not exceed the normal limits. The average sugar content of beetroots seems to be in direct relation to the average amount of nitrogen in the roots and leaves when it is a question of a slight increase in the amounts.

Intermediate Characters in Various Hybrid Species of Iris. I. DYKES, W. R. DOUGLAS. *Laws hold Good for Crosses between Species*, in *The Gardener's Chronicle*, Vol. 111, No. 1800, pp. 196-197, London, September 25, 1913;—H. MORLET, *Sur l'his* (reprises) in *Revue Horticole*, Year 27, No. 29, pp. 582-583, Paris, November 16, 1913.

1. The writer crossed various species of *Iris* to determine if Mendel's laws were valid between different species. The results with numerous crosses showed no dominance but only a blending of characters. *Iris baccata*, bulbous, with the beard of the sepals in the form of long fine golden hairs 0.117 to 0.234 inch in length, crossed with *I. tingitana* having no trace of hair gave a hybrid with hair distinctly visible to naked eye but less than 0.0585 inch in length.

Iris taurina (which has a tuft in place of hair) crossed with *I. cengiallia* (the type) gave a hybrid with a light violet coloured tuft bearing a beard.

Iris sibirica (with perianth tube) crossed with *I. tingitana* and *I. filifolia* (with perianth tubes 0.975 and 0.507 inch, respectively) gave hybrids with perianth tubes respectively 0.507 and 0.234 inch long.

Iris sibirica with solid stems crossed with *I. chrysographes* with the inter-nodality of the stem occupying about half the diameter, gave a hybrid with central hollow almost but not entirely closed with pith.

Iris sibirica with papery spathe which become entirely white and dry before protruding from the floral opening, crossed with *I. variegata* with green and herbaceous spathes gave a hybrid with spathes green in the proportion and parchment-like in the upper portion.

The hybrid between *I. reticulata* and *I. bakeriana* is intermediate between the parents as regards leaf shape.

Also with regard to the colouring of the petals many hybrids are intermediate between the parents of various species, e. g. *I. pallida* \times *I. variegata*; *I. trojana* \times *I. variegata*; *I. boissieri* \times *I. juncea*; *I. fulva* \times *I. foliosa*; *I. forrestii* \times *I. sibirica*.

All these cases appear to show that the law of dominance in the ordinary sense is not universal and is not always valid for crosses of different species.

With the exception of *I. chrysographes* \times *I. forrestii* and also possibly of *I. pallida* \times *I. variegata* and of *I. fulva* \times *I. foliosa* all the above hybrids were sterile both with respect to their own pollen and that of both parents. The two possible exceptions are cases in which the parents are so closely related whilst the fertile hybrid has more definitely related parents.

II. — Crossing *I. pumila* an early flowering species (beginning in April) with *I. germanica* of which the earliest flowers appear about middle of May, gives numerous varieties named *Iris interregna* flowering in the first half of May, thus enabling a continuous supply of flowers for several months (April to June).

These new Irises are intermediate between the two parent species only in date of flowering but for height, leaves and dimensions of flowers.

162. — **Calcium Hypochlorite as a Seed Steriliser.** — WILSON, J. K. in *American Journal of Botany*, Vol. II, No. 8, pp. 120-127, Lancaster, Pa., October 1915.

For certain physiological experiments seeds and plantlets free of active bacteria and fungi are necessary. Most attempts to secure seeds or plantlets in any considerable number have resulted in failure, because of the harmful effects of the germicide, its low efficiency or complicated methods required for treatment of the seed.

The writer reviews the various treatments tried from time to time by various investigators and notes the following substances as being frequently used: mercuric chloride, alcohol, formalin, hydrogen peroxide and combinations of these. None of these substances has been found to be as satisfactory as bleaching powder (calcium hypochlorite). The method of using this substance was as follows: 10 grams of commercial chloride of lime (titrating 25 per cent chlorine) is mixed with 140 cc. of water.

The mixture is then allowed to settle for 5 or 10 minutes and the supernatant liquid decanted off or filtered. The solution or filtrate, which contains about 2 per cent of chlorine, is used as the disinfectant. The volume of solution employed should be about 5 times or more the volume of the seed. It is not necessary to remove the traces of disinfectant from the seed, as it does not appear to interfere with the germination unless the post-treatment is exceedingly long.

Experiments with many species of seeds showed that the time required for sterilising the seed was in most cases several hours less than the time necessary to produce injury.

time required to sterilise the various seeds varies considerably: clover requires about 6 hours while wheat requires more than twice as long. The same method may also be used in the eradication of plant diseases by means of the seed.

Production and Commerce of Forage Plant Seeds in Canada. — CLARK, G. H., in *Canada, Department of Agriculture, Seed Branch, Report of the Seed Commission*, 14, Ottawa, 1915.

In the following Table I, the data of the clover and grass seed produced in Canada in 1910, are given according to the last Census.

TABLE I. — *Clover and grass seed produced in Canada.*

Provinces	Clover seed	Grass seeds
	pounds	pounds
Prince Edward Island	11 678	588 243
Quebec	1 352	36 330
Ontario	3 573	86 016
Manitoba	127 420	1 977 802
Saskatchewan	20 011 052	5 872 171
Alberta	900	115 131
British Columbia	16	75 016
Yukon	2 678	17 798
Northwest Territories	—	1 780
Total for Canada	20 188 049	6 772 096

Canada's exports and imports of clover and grass seed during the last 10 years ending March 31, are shown in the following Table II, which is compiled from the reports of the Department of Customs.

TABLE II. — *Exports and Imports of forage plant seeds in Canada.*

Date	Export				Imports	
	Clover seed		Grass seed		Clover and grass seed	
	Bushels	Value	Bushels	Value	Value	
		\$ £		\$ £	\$	£
1901	211 118	1 656 815 340 909	78 586	213 158 43 859	921 933	198 719
1902	93 976	938 633 192 134	111 246	205 917 42 163	715 604	154 651
1903	69 149	738 377 151 939	117 621	124 949 25 779	981 190	203 954
1904	118 601	1 094 330 226 405	110 873	106 708 21 958	1 051 881	211 436

In years of normal production there is sufficient red clover produced in Canada, mostly in southwestern Ontario, to meet domestic requirements, and considerable quantities are exported. Canada exports seed extensively in a year of average production, Toronto being one of the largest markets of the world, as all the seed sold in Canada is produced in Ontario. Alfalfa seed is almost entirely imported from the western United States and from Europe. The seed of white clover (*Trifolium repens*) is imported from Europe to Eastern Canada and from the north-western United States to Western Canada. Most of the clover seed sold in Canada is imported from the United States. The chief clover seed producing area of the world is within a radius of 250 miles of Chicago.

While practically all the field root seed in commerce is imported principally from England, France, Germany, Denmark, and United States, kinds are now being grown to a limited extent in different parts of Canada. The sources of seed supply may be divided as follows: *a*) the Experiment Stations, which grow standard and new varieties of grain under close supervision; *b*) farmers who are specializing in seed growing, have their seed inspected and produce excellent seed grain. (Crops grown by members of the Canadian Seed Growers' Association are inspected in the field and when threshed and ready to sell); *c*) reputable seed merchants; *d*) those who procure ordinary commercial grain intended for milling or use and represent it as seed; *e*) irresponsible travelling seed vendors.

The inspection of the seed trade, carried out in conformity to the Seed Control Act, has been intensified. More inspectors have been employed and the territory covered more thoroughly than ever before.

The following Table III gives the results obtained in the spring of 1921.

Table III. *Control of forage plant seeds in Canada.*

Provinces	Places visited	Traders visited	Violations of the Seed Control Act
Prince Edward Island	65	130	7
Nova Scotia	156	319	1
New Brunswick	120	305	35
Quebec	160	1,310	274
Ontario	643	1,586	224
Manitoba	135	402	58
Saskatchewan	141	555	87
Alberta	78	331	18
British Columbia	63	190	2
Total for Canada	1,861	5,173	708

(Continued on p. 219)

Selection of Wheats for Spring Sowing.— BIFFEN, R. H. (Professor of Agricultural Science, Cambridge) in *The Journal of the Board of Agriculture*, Vol. XXII, No. 9, 1911, London, December 1913.

February is the usual month for the sowing of spring wheat in England, but if this operation is delayed later than the middle of this month, some consideration must be given to the particular variety of wheat to be sown.

At this date the ordinary autumn wheats are decidedly risky; the plants will ripen late and be attacked by sparrows, or the plants may fail to ripen and merely continue their vegetative growth.

During the past season two of the safest autumn wheats for sowing up to the middle of February were "Squareheads Master" and "Little Joss".

Both these varieties were sown on several occasions in March with satisfactory results.

Some of the rapidly maturing varieties may be sown as late as April in May with success. Of these the following are recommended.

Early April Bearded; ears slender, lax and bearded, red or reddish-brown flour, grain red, slightly better quality than most English wheats, may be sown in April and harvested soon after autumn wheats.

Early Cheat; ears broad, dense and well set, with pale beardless chaff; grain red and of better quality than most English wheats; yields a better crop than the preceding but requires to be sown earlier.

Red Marvel (Red Admiral) or Japhet; imported from France, ears large, grain red, headless, dull white colour; grain red and of poor quality; straw liable to become discoloured; early sowings yield equal to autumn wheats.

Long Bourgot (Hâtil Inversable) of French origin; ear large, dense, grain red, of good quality; straw, short, suitable for deep rich soil; should be sown later than February.

For Fife, Burgoyne's Fife and Marquis are suitable in certain districts and grain of excellent quality. They may be sown any time between the middle and the end of April.

Local observations. Spring wheats must usually be sown a little earlier than autumn wheats; from 3 to 4 bushels per acre being usual. Dressing of $\frac{3}{4}$ to 1 cwt of sulphate of ammonia and 2 to 3 cwt of superphosphate per acre should be applied at seed time to encourage the plants and hasten maturity.

Wheat Growing Competitions in the Roman Campagna in 1914.— *Ministero Agricoltura, Industria e Commercio, Relazione della Commissione Giudicatrice*, pp. 1-80, Roma, 1915.

The plan of work of the commission comprised: 1) visiting the farms during the period between the appearance of the ears and maturation; determination of the variety of wheat grown; the nature of the land; the sowing crop; the manures and preparation of the soil; time and method of sowing; quantity of seed sown; appearance of the crop and damage caused by fungus diseases, etc.; 2) examination of the material from the point of view especially of the commercial characters of the grain (height of the plant, vigour of haulm, presence of rust, state of maturity of the ears,

quantity of grains per ear, general appearance, uniformity and weight of grain); 3) botanical study (weight per bushel, purity of grain, germination power, physical properties of grain) and chemical composition of the grain exhibited.

The wheats were divided into 7 groups, viz: Rieti, Olona, Colonna (presented by 6; out of 12; samples), Fucense tenero (soft) (7), Rieti (7), Gentile rosso, Carosella, Zucchetto, Noé (21), Inversable (9), Vilmorin's *Triticum turgidum* (5), Spring wheats (11). "Rieti" and "Fucense" were generally of normal specific gravity whilst their weight per 1000 grains was a little inferior to that of the same varieties cultivated in other regions. Compared with Rieti, Romanello did not show any appreciable differences with regard to the variation in the weight of grain but a higher specific gravity. In the case of Gentile Rosso the weight per bushel was generally high and the weight per 1000 grains still higher although it was somewhat lower on the whole than in the more northern regions.

The samples of Carosella wheat showed a higher weight per bushel and weight per 1000 grains than Gentile rosso. There was room for improvement in the weight per 1000 grains of some improved samples of Fucense and of the decidedly poor varieties of *Tr. turgidum*. The spring wheats showed normal condition with regard to these two characters. The maturation power was generally high for all the wheats exhibited so that conditions were favourable to the maturation of the grain. The Table are given the average, maxima and minima of the weight per bushel and per 1000 grains as well as of the physical characters of the varieties Rieti, Gentile rosso, Carosella and Inversable, in relation to the grain grown from the original seed and from seeds obtained by production.

Comparing the results of the various varieties exhibited, the following conclusions are drawn:

1) The conditions in the Roman Campagna are favourable to the cultivation of all the varieties of soft winter wheat at present more widely distributed throughout this region. With regard to quality, Colonna, Romanello appear to be superior to Rieti and Fucense and Carosella and Gentile rosso.

2) The varieties *Triticum turgidum* were not very successful on account of their long vegetative period and slow maturity. The quality of the grains also leaves much to be desired.

3) With regard to Vilmorin's Inversable, judging from the quality of the grain exhibited the writers consider this variety more suitable for more fertile and less exposed regions.

4) The results of the cultivation of spring wheats are very satisfactory from the point of view of quality of grain and they are always suitable to late sown autumn wheats.

5) A comparison of the quality of the grain obtained from the first and second generations of local seed and that of the grain from the original seed shows great promise from the selection work undertaken by the Ministry of Agriculture.

The results of the chemical analysis showed generally a fairly high nitrogen content in the wheats exhibited.

Out of 100 samples examined 55 contained from 14 to 16 per cent of nitrogen, 31 from 12 to 14 per cent and only 4 contained less than 12 per cent. The average nitrogen reached 16 to 18 per cent. All the samples contained more than the minimum of 25 per cent required for bread making.

The results of chemical analysis were as follows :

	per cent		per cent
Acidic ash (H ₂ O ₃)	9.70 — 14.94 70.8	contained from	1.85 to 1.98
Alkaline ash (Na ₂ O)	1.50 — 2.94 1.07		1.50 to 2.20
Phosphoric acid (P ₂ O ₅)	2.22 — 4.00 1.72		2.50 to 3.50
Water-soluble phosphoric acid	1.70 — 2.51 1.08		1.00 to 2.20
Starch	6.22 — 10.14 8.1		7.00 to 8.00

Comparing the nitrogen content of the samples grown from the original seed with that of samples of the same variety from different generations it appears that the climate of the Roman Campagna tends to increase the nitrogen content of wheats from more northern latitudes. Thus of 20 samples of wheat grown from original seed, 4 per cent had a nitrogen content less than 12 per cent ; 42 per cent contained from 12 to 14 per cent ; 46 per cent from 14 to 16 per cent ; 8 per cent more than 16 per cent, whilst of other samples of this variety grown locally 23 per cent contained less than 12 per cent of nitrogen, 65 per cent from 12 to 14 per cent and 12 per cent from 14 to 16 per cent. Similar variation was found in the case of the variety "Gentile rosso".

The report concludes with notes on : the climatic conditions of the Roman Campagna in their relation to the cultivation of wheat ; rotations of crops used and the improvements effected by adopting more modern systems of tillage ; to secure a more intensive cultivation by means of lucerne ; the clearing and drainage of uncultivated land ; the use of mineral manures.

Effect of Frequent Cutting on the Water Requirement of Alfalfa. — LYMAN J. BIGGS, *BUSCHNITZ U. L.*, in *Bulletin of the U. S. Department of Agriculture*, No. 18, 8 pp. Washington, 1913, p. 148.

The writers have carried out some experiments designed to determine whether alfalfa in the early stages of growth following a cutting has a water requirement differing from the water requirement of the plant during the third period of growth, and to what extent frequent cutting or grazing during the hottest part of the year modifies the seasonal water requirement.

Two standard sets of selected Grimm alfalfa, each consisting of six pots of plants, were employed in these experiments. The plants were treated in the usual way up to the time of the first cutting on July 26. Following this the growth on the pots of series *B* was cut back weekly, and the growth of the plants in series *A* was allowed to proceed without interruption until the time of the second cutting. Both sets were then allowed to grow uninterruptedly until the third and final cutting was made. The results were as follows :

Period of growth	Total dry matter produced (6 pots)		Total water absorbed (6 pots)		Water requirement based on dry matter	
	Series A	Series B	Series A	Series B	Series A	Series B
	Grams	Grams	Kilos	Kilos	Kilos	Kilos
May 24 to July 25 (43 days)	764.9	474.3	47.4.5	289.3	600 + 17	360
July 26 to Sept. 6 (42 days)	766.9	459.1	655.5	153.3	853 + 13	190
Sept. 6 to Nov. 4 (90 days)	104.9	223.2	105.1	101.8	421	100
Combined	2,927.4	854.9	1,325.1	547.4	956 + 11	650

1. Series B was replanted June 3.

The water requirement of the two series during the first period was practically the same. The difference is less than the probable error.

During the second period the water requirement of series B gave a decrease of 14 + 4 per cent on the water requirement of series A. It thus appears that alfalfa is slightly less efficient in the use of water when subjected to weekly cuttings. During the third period, the series B shows also an increase of 14 + 4 per cent in water requirement compared with series A, which is the result of the weakening of the plants during the second period by the forced reduction in the leaf and stem area of the plant. This tends to prevent the normal development of the root system, which in turn would increase the water requirement during the 3rd period, since a relatively greater proportion of food material would be diverted to the roots.

The water requirement based on the total dry matter produced during the season (May 24 to November 4) is practically the same for the two series, the difference, 14 + 13, being without significance. It is interesting to note that the final figure of series A is higher than that of series B, notwithstanding the fact that the water requirement of each of the three cuttings is higher in series B than in the check series. The explanation of this apparent anomaly is to be found in the relative yields during the second (midsummer) period, during which time series B produced only 18 per cent of its total dry matter, while the check series (A) produced 38 per cent.

Series A produced practically the same amount of dry matter during the second period as during the first, while series B produced only 30 per cent as much during the second period. Series B was also maintained during the midsummer period with an actual expenditure of only one third the water required by series A. This forced economy in the use of water for frequent cutting seems not to be without effect on subsequent production. Series B produced only 48 per cent as much dry matter during the third period as the check series, while during the first period, notwithstanding a shorter period of growth, series B produced 60 per cent as much dry matter as the check series (A).

The results here recorded indicate that the total consumption of water can be controlled to a considerable extent by pasturage or frequent clipping. This affords a means of limiting the growth of the crop so that its demand for water will not exceed the available moisture supply. It is evident that the greatest production can be obtained by allowing the crop to grow when its water requirement is lowest, i. e., in spring or autumn and by keeping the surface at a minimum during the summer through clipping or grazing. This affords a simple and practical means of obtaining a return from alfalfa commensurate with the available moisture and at the same time avoiding the danger of drought injury. The writers state that a practice of grazing that suggested has been gradually developed in Australia, where the crop is grown in the early spring and the alfalfa is pastured during the remainder of the year.

On the other hand the results of the experiments described show that where the moisture supply is adequate for continuous crop production during the season, close pasturage or clipping would result in a marked reduction in the amount of alfalfa produced. Consequently where grazing is practised for crop production can be secured by intermittent grazing, that is by enclosing several fields which are pastured in rotation.

Scotland's Upland Grazings. MACNICHOLSON, D. and SMITH, W. G., in *The Estate of the Crown*, Vol. XV, N. 11, pp. 606-610. London, November 1915.

Upland grazings occupy in Scotland 48 per cent. of the total land of the Kingdom. These lands are mainly devoted to sheep farming with flocks of Blackface and Cheviot mountain breeds. Cattle grazing occupies the marginal areas. The grazings are classified as belonging to five distinct types, namely:

1. Peatlands. - (*Calluna*, *Eriophorum* and *Scirpus caespitosus*).
2. *Nardus* Grassland. - (*Nardus stricta*).
3. Heatherlands. - (*Calluna*).
4. *Molinia* Grassland. - (*Molinia caerulea*).
5. Alluvial and Flush Grasslands.

The extent and distribution of the individual types are determined chiefly by topography and climate, but past history, and interference by methods of man are important e. g., grazing, burning, draining, liming. The types are relatively constant throughout, but may occur in various combinations in association with differences in the factors. Thus in different localities the grazing areas present distinctive features. This involves different systems of management, e. g., dry south-eastern area and humid western area of Scotland. Alluvial and flush grasslands, heatherlands and peatlands are of little value to the grazier. *Nardus* and *Molinia* are of secondary importance. The value of a grazing depends on a suitable representation of types and on their relative disposition.

Dealing with the improvement of these lands, it was shown that alluvial and flush grasslands can be made to replace heather and *Nardus* by "the irrigation with water derived from springs or with surface-water during rain-wash. Invasion of acid water deteriorates the pasture, favours heather, and, where "pan" is formed, promotes retrogression to moorland.

These grasslands are suitable subjects for manurial treatments, and for the use of lime and silicic slag. Destruction of bracken increases the productive capacity of the pasture.

The grazing value of heatherlands is greatly increased by regular burning on a suitable rotation. Renewal of burnt areas results through: 1) Regrowth from the shoot; 2) Colonisation by seedlings. The former gives the most rapid recovery. Types of heatherland with slow and rapid rejuvenation powers require different burning rotations respectively. Draining improves the proportion of heather in peatlands, but reduces that of cottongrass (*Trichophorum*) and deer-hair grass (*Scirpus caespitosus*), and favours that of *Nardus*. Little improvement is possible.

Where flushing is possible good pasture may be induced, otherwise *Nardus* and *Molinia* areas grazing value is improved by burning on a 12-yr. rotation.

105. **Cultural Experiments Conducted in Denmark with Different Mixtures of Seeds of Forage Plants.** LINDHARD, E. in *Fodskud for plejedyr*, Vol. 2, 1913, pp. 11-14, Copenhagen, 1914.

The results obtained by the writer during his experiments that covered a long period (1900-1912) are of considerable interest, for they are in direct contrast to the theories at present obtaining as regards mixture seeds in the case of forage plants.

At the time of his experiments, the writer used as a comparative mixture one recommended by Nielsen which has long been commonly employed in Denmark, namely:

Early red clover, <i>Trifolium pratense</i> , 100 lbs. per acre	<i>Phleum pratense</i> , 100 lbs. per acre
<i>Lolium hybridum</i> , 1.5	<i>Festuca pratensis</i> , 100 lbs. per acre
<i>Trifolium repens</i> , 100 lbs. per acre	<i>Lolium perenne</i> , 100 lbs. per acre
<i>Trifolium repens</i> , 100 lbs. per acre	<i>Lolium pratense</i> , 100 lbs. per acre
<i>Trifolium repens</i> , 100 lbs. per acre	

Which makes in all about 20 lbs. per acre.

From its composition, this mixture is as suitable for grass as for clover; it gives an early cut, and an abundant new, summer growth, both in the 1st and 2nd years; the yield is certainly not very great, but it is constant and equal from year to year, even in the event of the red clover producing little. The large number of species composing this mixture prevents an entire failure of growth as often happens when only the most productive types are used.

On increasing the *Agropyrum* percentage at the expense of *Avena fatua*, the hay crop decreases, if on the other hand, *Avena fatua* predominates, the yield is large. It should, however, be noted that this latter mixture will not grow on calcareous soil and is not suitable either for grass or pasture.

By substituting *Lolium perenne* for *Agropyrum*, the amount of hay increased in the 1st year, but the crop is smaller in the 2nd year. If *Agropyrum* is replaced by *Panicum*, an abundant hay crop is obtained in the 1st year, but the new growth is scanty.

the experiments carried out by the writer, *Festuca pratensis* did not give good results, as far as the hay crop was concerned, and proved very particular in the soil, which has to be damp, rich in humus, and liberally manured. *Lolium hybridum* only gives a good crop when the summer is cold and dry, while *T. repens* grows abundantly in low, cold localities. In order, however, to insure a good and constant crop of hay, it is necessary, as is otherwise known, to mix the *Gramineae* with forage *Leguminosae*.

Amongst the latter, red clover is much prized; it can, in certain cases, be mixed with advantage by *Lotus corniculatus* and by lucerne, which may yield the 2nd year. In places where the special conditions of soil and climate require that red clover should be entirely excluded from the mixture, because of its doubtful success, it is advisable to replace it by *Lotus corniculatus*. Though the latter has a somewhat late spring growth, its growth is on the other hand abundant, and it does better in the 2nd year than red clover. As for lucerne, it yields little the 1st year, but grows strongly in the 2nd and 3rd years.

The following is a summary of the results obtained with 10 *Gramineae* and 10 *Leguminosae* combinations, which in their entirety, correspond to the most diverse cultural conditions, and when used suitably according to the individual conditions, give a much larger yield than the ordinary Nielsen mixture:

1. Early red clover and *Avena fatua* for biennial stands; the oats grow the 2nd year.

2. Early red clover and *Poa* for damp soils where clover does not thrive.

3. Early red clover and *Lolium italicum* for annual stands; growth present the 1st year, and new growth very stout.

4. Early red clover and *Lolium perenne*: hay crop same as with preceding mixture, but new growth less strong.

5. Late red clover and *Phleum pratense* in biennial stands give a considerable amount of hay, but the new growth is weak.

6. *Trifolium agrarium* and *Lolium perenne* in annual stands behave like the preceding mixture.

7. *Trifolium agrarium* and *Lolium italicum* give an early cutting and abundant new growth.

8. *Anthyllis* and *Bromus arvensis* give a plentiful last cut.

9. *Anthyllis* and *Lolium perenne*: their cut is neither too early, nor too late, their new growth is abundant.

Cultural Experiments in Germany with *Trifolium pratense* from 18 Different Localities. — ROEMER, C., in *Illustrirte Landwirtschaftliche Zeitung*, Year 35, No. 10, p. 574, Berlin, November 3, 1913.

From 1914-1915, the writer experimented in order to determine the relative value of the different kinds of red clover on the market shown under natural conditions in Germany. For this purpose, he collected seed of red clover from 18 different localities, including the best-known clover-growing districts of Germany and also foreign countries. Each sample consisted of a mixture of seed of different local varieties which had not

been improved by selection, but faithfully representing their native characteristics.

The writer sowed the seed from each locality on 4 separate plots of 1 sq. yd. There were thus in all 72 plots. The seeds were sown in the spring of 1914 without any cover crop and the first cut was made on the 10th of July following; the second cut in 1914 was not controlled by the writer. In 1915 two cuts were made, one on June 14, the other on September 28. The yields from each cut are given in the following Table.

Original locality (1) Locality	Green crop in lbs. per plot				Hay crop in cwt. per acre	Total yield in cwt. per acre
	1914 cut July 10	1915 cut June 14	1915 cut September 28	Total		
1) Silesia	27.72	54.44	16.8	101.80	65.63	
2) Holstein	26.26	55.44	16.06	100.76	64.66	
3) Thuringia	31.08	47.52	16.28	97.78	63.39	
4) Transylvania	27.72	50.82	18.48	96.82	62.43	
5) Brandenburg	31.08	48.76	18.48	95.92	61.80	
6) Bohemia	31.02	48.76	16.28	93.06	58.64	
7) Chile	33.66	37.18	16.38	90.12	57.97	
8) Russia	24.68	17.30	16.06	88.04	56.70	
9) Austria	22.60	17.74	17.02	86.76	55.75	
10) Baden (Randener)	24.20	13.56	18.70	86.76	55.75	
11) Lower-Rhine	23.08	38.64	16.30	83.38	53.44	
12) N. Germany	26.24	47.06	14.74	82.04	53.44	
13) N. France	26.76	11.14	11.88	82.72	51.49	
14) S. England	26.76	11.14	11.88	82.72	53.49	
15) Rumania	23.66	10.48	14.52	80.66	51.02	
16) S. France	25.52	36.66	14.30	76.42	50.97	
17) Palatinate	23.68	36.66	14.52	76.26	50.97	
18) Moravia	26.40	11.58	14.66	77.00	49.38	

The best sample of red clover produced a crop exceeding the worst one-third. There are thus very great differences between the crops of the clovers introduced from the above-mentioned localities. The writer's experiments were carried out in East Germany. It is therefore necessary to choose for this part of Germany clovers coming from East Germany or else from Central Germany, or from foreign countries situated to the west of East Germany. The writer concludes that in choosing clover seed attention should be paid than heretofore to the locality of origin.

Native Pasture Grasses of the United States. — GRIFFITHS, D. (Agriculturist,

U. S. Dept. of Agriculture, Chief of Cattle-Feed and Grain Investigation Laboratory, and Cooper Assistant Chemist, Bureau of Chemistry) in *U. S. Department of Agriculture, Professional Paper*, pp. 1-52, Plates I-IX. Washington, D. C., May 1913.

This bulletin consists of a compilation of the results of investigations from various sources on the economic value of the numerous forage plants growing in the United States.

The alphabetic arrangement has been adopted as being more serviceable than one conforming to botanical usage. Few botanical data are given, the importance being attached to chemical analyses in relation to the value of the plant.

American Cotton in the Punjab. — ROBERTS, W. (Professor of Agriculture, Punjab) in *The Agricultural Journal of India*, Vol. X, Part IV, pp. 313-318, pp. 313-318, October 1-15.

American cotton was first introduced into the Punjab in 1884 when Georgian seed was tried. The crop grew well but survived only in the form of stray plants mixed with the native cottons. It was first raised in 1902, and in 1903 experiments were made with acclimatised seed at Lyallpur, but it was not until 1905 that the work was carried systematically by the Department of Agriculture.

In 1911 the area under American cotton was less than 10,000 acres, but in 1914 it was not less than 70,000 acres. It is now well established that the yield of American cotton is on the average better than that of the native types and the critical period in its adoption is now passed. The plant has established itself by a sort of natural selection, unsuitable types having been largely eliminated by pests. The Agricultural Department has also been able to obtain the support and co-operation of local ginners and of merchants who have done much by issuing pure seed and securing good prices at the auctions. One of the great difficulties is the mixing with native cottons that occurs, often due to the faults of the ginners and spinners.

***Urena lobata* a Wild Malvacea of Madagascar** (1). — Bulletin de l'Œuvre Coloniale, 1913, Nos. 62-63, pp. 371-379. Mohon, August-September 1913.

This shrub attains a height of from 5 ft. to 9 ft., or even more. Its stem is straight and the alternate cylindrical branches bear stellate hairs which are sometimes almost tomentose. The leaves are alternate, suborbiculate, more or less dentate or lobed, cordate, and truncated or cuneate at the base and hairy.

This *Urena lobata* is very polymorphous as regards the form of its leaves, and has been described by writers under a considerable number of names and possesses more than 20 scientific synonyms.

This plant, which is met with in all the hot regions of the globe, has been known for a long time as producing textile fibres. Amongst its popular names the following may be mentioned: Banochra, Cay Bazloung, Cousin du Grand Cousin, Mahot Cousin, Paka, Sikilengi, Kirijy, Kisiza, Pam-

piana, Puéhu, Hérissou rouge, Grand Mahot, Cousin, Pisipini, and Aroinina. The textile fibre is more resistant than jute and comparative experiments have shown that it can be very useful in the manufacture of sacks. It is also most probable that by the employment of suitable chemical methods, very white, fine, strong fibre could be obtained which would be well adapted for making textile fabrics and lace, as the thread takes very well. Paper made from *Urena* is very resistant.

In Madagascar this plant is chiefly found on alluvial soil and along river courses. Its cultivation entails practically no trouble, for it grows from seed and is easily propagated by cuttings. The operation of extracting the fibre presents no difficulties. After being immersed in water for some days, strands up to 6 ft. in length can easily and rapidly be drawn out. Regia usually gives a greyish thread of which portions are more or less clean. When prepared and combed, the thread is whiter and more silky; its appearance is very similar to jute. Its use is at present limited to the manufacture of very resistant ropes and string, more rarely it is employed for large fishing-nets and coarse, but very durable, textile fabrics.

In order to encourage the exploitation of *Urena*, the Government of Madagascar and its Dependencies has issued an order granting concessions for the installation of a factory, the cultivation of *Urena lobata*, and the right of gathering it.

**RUBBER,
GUM AND RESIN
PLANT**

17. **Experiments in Java on the Fickendey Method of Tapping *Hevea brasiliensis*.** — Dr. LONG, A. W. K., in *Vegetumkunde*, Year XXVI, Parts 8 and 9, 1923, p. 101.

Dr. Fickendey's method, consists in removing the suberous layer beneath the incision by scraping a strip of bark about 3 cm. wide, care being taken not to cause the latex to exsude. According to its inventor, this method should increase the latex yield from 10 to 20 per cent.

The chief observations made by the writer were as follows:

In tapping every day, a somewhat larger yield was at first obtained by the Fickendey method, but after 6 months of experiment, the average yield of the trees treated in the ordinary way proved to be a little more plentiful.

In comparison with other methods, the Fickendey system has not given satisfactory results and has even had an injurious effect upon the trees.

18. **Experiments on Extracting Rubber from Dead *Hevea* Leaves in Java.** — VRIENS, J. G. C., in *Mittheilungen an den Adressaten der A. V. R. O. S.*, No. 1, 1925, Melan, 1925.

The writer treated with benzol the dead leaves which were still on the *Hevea* trees before the normal leaf-fall and compared the results with those obtained by the treatment of young leaves that had just reached their maximum development. The results of these extractions were such that it was impossible to obtain an appreciable amount of rubber.

Taking into account the high price of the necessary chemicals, therefore comes to the conclusion that it does not pay to extract the latex of dead leaves for the purpose of making rubber.

Data Collected During a Visit to Besoeeki (Java) for the Purpose of Studying Tobacco-growing. -- DE VRIERS O., in *Mededeelingen van het Proestatuut van Versoenda*, No. XVI, 24 pp. Semarang, 1915.

The writer describes the special conditions obtaining in Besoeeki, where tobacco leaves are bought by tobacco makers from the native growers. This system makes it difficult to exert any influence upon the growing and harvesting methods. At Deli, and elsewhere in Java, (in Sumatra, where tobacco-growing is practised under the direction of Europeans) is much better developed and attains a high degree of perfection. The method of cultivation, the choice of the different kinds, (the "Kedoe" and hybrids) the treatment of the leaves etc., vary considerably from one place to another according to the special conditions of climate and soil.

Originally, a type of tobacco ("Vorstendse Kanari") was grown in Besoeeki which burned badly and gave a grey ash. Since the cultivation of hybrids obtained by crossing the Deli and Kedoe tobaccos the product has considerably increased in value.

One of the hybrids is obtained by artificial pollinisation on a large scale of the female parents, (originally coming from Besoeeki), being fertilised after the removal of their stamens, with pollen from plants of the Deli and Kedoe varieties. The Deli x Hatano hybrids do not produce such satisfactory results, from the point of view of combustion, as the Deli x Kedoe hybrids.

The average yield is 1,200 lbs per *baboet* of 1.53 acres (755 lbs per acre). The leaves are dried with great care, the temperature in the drying being regulated by open wood fires.

Contrary to the practice elsewhere, tobacco in Besoeeki is first subjected for 1 to 3 months to slow fermentation during which the temperature rises above 95° F. After this preliminary fermentation, the leaves undergo main fermentation according to the system obtaining in Deli and elsewhere.

As a large sum cannot be expended upon sorting the leaves of a tobacco for the quality, this operation is carried out very roughly, while the leaves of finer quality which are more prized in the market are treated with greater care and sorted with much exactitude. In this way, a product raised in Besoeeki which is only worth about 4 d per lb on an average like the other types of tobacco (such as the hybrids) fetch as much as 10 d per lb.

Chemical Composition of the Autumn Leaves of the Mulberry. -- DI MADO, CLELIA, in *Annali di Chimica Industriale*, No. 1, 1915, pp. 1-12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, Modena.

With a view to obtaining some information on the feeding value of mulberry leaves in the autumn, analysis was made of the leaves of two varieties ("Trentin" and "Sterile") collected at different periods. The plantation in which the leaves were taken was established in 1807. The average weight of the leaf of "Trentin" variety was 2.50 gms. and that of "Sterile"

1.62 gms. "Trentin" No. 6 and "Sterile" No. 6 were cut during the autumn and were not stripped in the following spring.

The results are given in the following table as percentages of dry weight of leaf.

Substance	Percentage of dry weight of leaf				
	"Trentin" No. 6 Leaves of second growth	"Sterile" No. 6 Leaves of second growth	"Trentin" No. 2 Leaves of second growth	"Sterile" No. 2 Leaves of second growth	"Trentin" No. 6 Leaves of first growth
Water-soluble	70.40	74.31	69.60	74.10	76.00
Protein bodies	6.28	5.13	6.20	5.00	6.00
Protein fraction	5.04	4.08	5.10	4.10	5.00
Fats (bodies)	1.60	1.24	1.50	1.80	1.80
Non-nitrogenous extract	11.08	11.24	10.30	12.40	12.00
Pentosans	2.81	2.60	2.80	2.52	2.70
Cellulose	2.60	2.68	2.50	2.60	3.00
Ash	3.95	4.48	3.50	3.95	4.50

In spring leaves (first growth) of various varieties MENOZZI found 4.25 to 6.68 per cent (dry matter) of pentosans whilst the above figures, expressed in terms of dry matter become 0.45 to 10.21 per cent of dry matter. Direct experiments are required to determine the influence of these substances on the feeding value of the leaf. The searches of MENOZZI lead one to believe that the silk-worm only partially digests the pentosans and that this portion is proportional to the amount of cellulose present, or else that neither pentosans nor cellulose are digested.

The above results show that the period of cutting the leaves has an appreciable influence on the composition of the autumn leaves and that sensible spring leaves in nutritive value to the silk-worms.

17 Ringing Fruit Trees (HOWE, G. H. in *New York Agricultural Experiment Station Bulletin*, No. 304 pp. 578-584, Geneva, N. Y. 1915).

With the object of testing the value of ringing (i. e. removal of complete ring of bark) fruit trees with respect to their productiveness, experiments were carried out during 1910-1913 with apple, pear, and cherry trees.

The results showed that under certain conditions ringing may increase and possibly increase fruitfulness of apples, but it rarely has these effects on other fruits. The removal of narrow strips of bark is less injurious to plant growth than taking out wide rings. The practice is never to be followed with stone fruits and only on young and very small apple trees. The operation had no effect on the size, colour or number of the apples and the roots were diminished in size and vigour.

18 - Apple Orchards in the North West of the United States. — See No. 10.

Buried Peach Orchards. — CLARK, FLORENCE L. in *The Country Gentleman*, Vol. LXXXI, 1907, 2 figs. Philadelphia, October 23, 1918.

The mountain range, from 10 000 to 14 000 feet high, divides the State into two parts differing considerably from each other in climatic conditions. While the western half is admirably suitable to fruit growing, the eastern slope is subject to spring frosts which render the growing of many kinds of fruit, especially peaches, very risky.

Some years ago, W. B. Felton began experimenting with burying peach trees in winter, and now his system is followed with great success in the State of eastern Colorado, some orchardists apply it to thousands of trees, but it is specially for the home orchard where peaches are rarely grown on account of the cold climate.

In starting an orchard with the intention of protecting it during the winter, Colorado growers set out yearling trees in the spring. The roots on opposite sides are cut off and the trees are set in the row with the roots at right angles to the direction in which it is proposed to bury the orchard down. This direction is determined by the winds.

The following autumn and every autumn afterwards the trees are put down. When the leaves have dropped and the trees have ripened for winter, the ground is dug to each tree and water is turned into it and allowed to run till the ground is thoroughly soaked. The trees are worked back and forth towards in order to permit the water to reach the roots and loosen them.

The trees, even the largest and oldest, provided they have been buried every year, can easily be pushed over with little injury to the roots.

It is difficult to undermine old trees that have never been buried. A plank is put on top of the tree as soon as it is pushed over to hold it until the straw and earth can be placed. Roots, trunks, and branches are entirely covered. Just straw enough is used to prevent the earth from blowing through. As for earth, one inch of it, provided no holes are left, is even found sufficient to protect the buds through a temperature of below zero.

In the spring the uncovering is done gradually, care being necessary to get the best result. About the middle of April the growers begin to remove the straw without disturbing the straw. Ten days afterwards if the weather is favourable the straw is loosened to give the blossoms air. Then about the first of May the straw is given a second shaking. When all danger from frost is over, about the middle of May the trees are quite uncovered and raised, and then masses of pink blossoms, with sometimes tiny green peaches, are seen on the blossoms.

In lifting the trees the ground is again saturated with water. The trees will stand well alone and require short props.

This annual uprooting does not seem to be at all harmful to the trees. The trees are as long and are said to yield as much fruit, in proportion to the size of their tops, as those grown under more favourable climates.

* Production of Peaches in the United States. — See No. 217 below.

161. **The Chemical Composition of the Fruits of *Anona Cherimolia* M. C. TOTO**, ALESSANDRO (Municipal Laboratory of Naples), in *Le Scienze sperimentali*, Vol. XLV, Part 12, pp. 876-898. Modena, 1918.

After reference to previous research upon the fruits of *Annona*, which there are no complete analyses), the writer describes the first analysis he himself employed in his study of the fruits of *Annona media* (gathered at Reggio Calabria): he obtained the following results.

Average weight of fruit 130 gms.; maximum 202 gms.; minimum 85

Percentage Composition of Fruit.

Pulp	61.29
Rind	29.20
Seeds	11.11
Pectinide	1.59

Percentage Chemical Composition of Fruit.

	Fresh fruit			In dry weight	
	Pulp	Rind	Seeds	Pulp	Rind
Water	73.17	67.40	6.78	—	—
Fixed acid in citric acid	0.823	0.540	—	3.10	1.7
Volatile acid in acetic acid	0.035	—	—	0.132	—
Reducing sugars	10.10	1.00	0.15	37.00	12.1
Saccharose	1.76	1.04	—	6.03	3.15
Albuminoids (N. $\times 6.25$)	2.80	2.01	1.72	10.55	6.12
Pectine	0.12	—	—	0.452	—
Cellulose	4.08	15.72	26.05	15.38	48.1
Fatty matters (soluble in ether)	0.349	0.350	0.00	1.32	1.7
Ash	1.85	1.74	1.38	6.07	5.29
Undetermined and lost substances	1.013	0.241	—	17.776	19.20
Aqueous extract	13.60	1.02	—	51.48	15.01

(From the original.)

Alkalinity of ash, expressed in K_2CO_3		Characters of fats	
Pulp	32.1	Refractive index at 25° C.	
Rind	51.5	Index of saponification	
Seeds	54.5	Index of acids	
		Index of ethers	
		Moissl number	

The appendix contains a bibliography of 10 works.

Variation in the Flowers of the Papaya.—KUTKARNI, L. B. in *The Poona Agricultural College Magazine*, Vol. VII, No. 2, pp. 102-112, Plates I-IV, Poona, 1915.

The papaya plant is extremely variable in its sexual characteristics, stages between the monoëcious and dioecious forms being met with. Observations on individual trees have shown that these stages succeed one another in the same tree at different stages of its growth.

The successive stages in development of a male plant may be described as follows:

- (1) Stage 1. Male flowers only.
- (2) Stage 2. Male + hermaphrodite flowers.
- (3) Stage 3. Hermaphrodite flowers only.
- (4) Stage 4. Hermaphrodite + female flowers only.
- (5) Stage 5. Female flowers only.

The first formed hermaphrodite flowers are apocarpous as distinct from the stamens and the female flowers which are syncarpous.

These changes do not appear to be in any way connected with the retention of the terminal bud, but merely with the increasing age of the tree.

The Classification of Mango Varieties.—BURNS, W. (Economic Botanist, Bombay) and BHAVAR, S. H. (Bombay Agricultural Department) in *The Agricultural Journal of India*, Vol. X, Part IV, pp. 371-379, 1 Plate. Calcutta, October 1915.

The writers suggest an artificial system of classification for the numerous kinds of Mango occurring in India, based on the following characters of the fruits:

- (1) Right and left shoulders,
- (2) Basal cavity (attachment of stalk),
- (3) Beak,
- (4) Apex,
- (5) Suture on left side,
- (6) Three dimensions,
- (7) Weight,
- (8) Colour,
- (9) Surface, nature and distribution of the small spots on the skin,
- (10) Gloss of skin,
- (11) Flesh, taste, colour and stringiness,
- (12) Stone, size, weight, fibre and markings.

Hybridisation experiments have been begun from which it is hoped to obtain some information as to the origin and inter-relationships of the best varieties.

The Diagnostic Value of Grape Pips.—(Work of the Royal Hungarian Ampeological Institute.) ANDRASOVSKY, J., in *Bariszati Lapok*, Year 17, Nos. 37 and 39, (Supplement), Budapest, 1915.

The pips of the varieties of grapes cultivated in Europe generally differ from those of the American varieties in their long, thin beaks and also in the position of the hilum which in the European varieties is situated on

the extreme portion of the lower surface and usually not in the middle, but at a third of its length. There are also more or less marked differences between the pips of the different varieties of European grapes, the question has been raised as to whether these differences could be of diagnostic value.

As early as 1872, MILLARDET (1) remarked the importance of grapes in distinguishing between the species of wild vine. Engelmann (2) was one of the first to recognise their importance. On the basis of the shape of the pips, he tried to elucidate the characteristics of variety and, in the case of the wild vines of the United States, and to establish a classification. In the same manner FOEX and VIALA in 1885, and R. GOEHRMANN (3) in 1887 attached great importance to the differences observed in the pips of American grapes. POTEBSJA (4) wrote on this paper on the diagnostic value of grape pips. From his observations on vines from the Crimea, he established 10 types according to the shape of the pips, their length and width, the proportion between them, the roundness of the hilum, the shape and position of the hilum, the development of the hilum, etc.

Although his researches are very valuable, his theory cannot be put into practice. In 1912 A. BONNET (5) published his important observations and described in several tables, the pips of the different vines and American hybrids which he had examined.

In 1912 and 1913, the writer examined, from a diagnostic point of view, a large number of vines cultivated in Hungary, and he was able to confirm the statement that there are a fairly large number of vines which, in certain cases, can be distinguished by their characteristic pips. According to the writer's observations, the following characters are of importance from the diagnostic standpoint.

1) *For the identification of groups*: the general form of the pip (the body and beak), its weight, length and breadth (expressed in mm.), the proportion between length and breadth.

2) *For the identification of varieties*: the colour of the pip, the shape and exact position of the hilum etc.

The writer tabulates the weight of the pips he examined in figures obtained agree in a general manner with those given by the other authors. Taking these data as a basis, it is possible to distinguish: *light* pips of which weigh less than 2.5 gms.; pips of *medium weight* of which 100 weigh from 2.6 gr. to 3.5 gms.; *heavy* pips of which 100 weigh over 3.5 gms.

The length of the pips varies between 5 and 8 mm., and their breadth between 3 and 5 mm.

(1) Millardet, *Étude sur quelques espèces sauvages de l'Amérique du Nord*.

(2) Engelmann, *Les Vignes Vignes des États-Unis*, 1876.

(3) R. Goehrmann, *Handbuch der Ampelographie* 2nd Edit. Berlin, 1887.

(4) Potebnja, *Die Samen von *Vitis vinifera* und ihre Bedeutung für die Klassifizierung der Sorten*, in *Beitrag zur Ampelographie*, 1911.

(5) A. Bonnet, *Étude sur le graine*, 1912.

(6) 1912.

On examining the ratio between breadth and length, the writer found it varies between 1 : 1.5 and 1 : 2.3. To these limits correspond respectively the pips of the Léanyka vine which measure 4×6 mm. and those of the Italian Riesling which measure 3×7 mm.

The colour of the pips is variable. In general, in the varieties with long beaks, the pips contain more colouring matter than in those with short beaks. The pips of the first are often of a bright copper hue and show a purple colour, those of the second are light brown, occasionally they are sometimes reddish brown (Ezerjő variety), in this variety, however, a mature vine is also reddish brown on account of its property of containing a larger amount of colouring matters.

As has been said above, in the pips of the European varieties the hilum is placed on the extremity of the lower side. Its development is variable: in some varieties, the hilum is scarcely visible, in others, on the contrary, it is well marked and perhaps surrounded by a groove, or the groove may be continued as far as the upper portion of the pip, bifurcating at the end of the raphe.

On the basis of these characters, the writer has tried to arrange the grape varieties according to their pips in the following manner:

Group I. — Body of pip somewhat round.

1. Small light pips: length 5. to 5.5 mm., more rarely 6 mm. (in group 5 mm. on account of the long beak): breadth 3 to 3.5 mm.; weight 1.5 to 2.5 pips: from 1.8 to 2.5 gms.

Examples classified under this group:

a. Short beak "Juhfarku", "Mezesther", "Valtdiner rouge".

b. Short beak "Muscat d'Alexandrie".

2. Pips of medium size and weight: length about 6 mm.; breadth 4 mm.; 2 to 3 pips: from 2.5 to 3.5 gms.

Examples "Blanc de Bourgogne", "Petit Blanc"; "Rose de Berég", "Rouge de Tramini".

3. Large, heavy pips: length 7 to 7.5 mm.; breadth 4 to 5 mm.; weight 3 to 4 pips: 3.5 to 4.5 gms.

Examples "Elbling", "Aramon", "Chasselas";

Group II. — Body of pip oval.

1. Small light pips: length 5 to 6 mm.; breadth 3 mm.; weight of 2 to 3 pips: 1.8 to 2.5 gms.

Examples "Bakator", "Kovidinka", "Erdi", Szerémi gold (Green gold Szerémi).

2. Light pips of medium size: length 6.5 to 7 mm.; breadth 3 to 3.2 mm.; 2 to 3 pips: 2. to 2.5 gms. The proportion between breadth and length is 1:1.2 and even more.

Examples "Italian Riesling", "Oporto".

c) Pips of medium size and weight (with relatively short beak); length 6 to 6.5 mm.; width 3 to 3.5 mm.; weight of 100 pips; 2.5 to 3 gms.
Varieties "Leányka", "Rhenish Riesling", "Cabernet".

d) Pips of medium size and weight, with extremely short beak; length 6 mm.; breadth 4 mm.; weight of 100 pips; 3 to 3.5 gms.
Variety "Kéknyelű".

e) Pips of medium size and weight with longer beaks; length 7 mm.; breadth 4 mm.; weight of 100 pips; 2.6 to 3.5 gms.

Varieties "Kékfrankos", "Királyszőlő", "Mustofehér", "Green Finger", "Ezerjű", "Hárslevelű", "Járdovány", "Kék".

f) Pips of medium size (thin) and medium weight; length 7 mm.; breadth 3 to 3.5 mm.

Varieties "Csomorika", "Szankamenka", "Liszttesfehér", "Savány".

g) Large, heavy pips; length 7 to 8 mm.; breadth 4 to 5 mm.; weight of 100 pips; 3.6 to 4.5 gms.

Varieties "Fünnel", "Szentolörincz", "Génauai zamatos (genetic Genoa).

Seeing the utility of information regarding the pips, the writer hopes that wider and more exact data will be obtained by further research.

189. **Hybrid Self-Bearer Vines in France in 1915.** — P. L. LAFAY, L. G. LAFAY, *Annales d'Agriculture*, Year 41, No. 20, pp. 387-392, Paris, November 13, 1915.

A summary of observations made near Toulouse. Hybrid self-bearers vary considerably in their resistance to mildew. Thus, during the attacks of disease in 1915, Seibel Nos. 2, 1020, 1077, 1082 and 1387 were almost free from disease after two treatments, whilst Seibel 128 failed to withstand the attacks to which in normal years and on the same soil it was liable.

Good direct self-bearer hybrids are as follows:

Blue hybrids: Seibel No. 873; Seibel No. 4121; Seibel No. 1082; Malgègne No. 820-6; Malgègne, 2004-3; Malgègne 2183-3; Baco No. 1; Jumeil; Gaillard 104; Condere or Contassot 7120; Condere No. 106-40.

White hybrids: Seibel No. 703; Seibel No. 880; Seibel No. 203-5; Seibel No. 4045; Seibel No. 4001; Malgègne No. 57-1; Malgègne No. 117; Malgègne No. 1047-8; Malgègne No. 1807-12; Condere No. 235-120; Condere No. 272-00; Girard No. 157.

Rose hybrids: Seibel 2857; Seibel No. 4104; Malgègne No. 47-2.

The writer has observed additional cases of self-bearer hybrids more resistant to disease than the same hybrids grafted on vine stocks. Cases in point are: Seibel No. 128, Seibel No. 1077, Gaillard 104, No. 157, etc.

190. **Manurial Experiments in a Woodland Nursery in Austria.** — RUSSEK, *Zeitschrift für Kulturpflanzenbau*, Year 41, Nos. 8-9, pp. 171-179, Vienna, 1915.

In 1914, the writer experimented in a woodland nursery with a view to determining the effect of phosphoric acid upon young plants.

of spruce and pine. He used as phosphatic fertilisers, degelatinised bone meal and basic slag. The results showed that these two fertilisers have an equal effect upon young spruces and pines and that when applied in different quantities (60 + 180 + 360 + 720 lbs. P_2O_5 per acre) the results were all the same. From this the writer concludes that conifers are able to assimilate very quickly the slightly soluble phosphates in the soil, because these fertilising substances are not as necessary to agricultural plants.

In continuation of this experiment, LORENZ also made an experiment in a seedling nursery for the purpose of comparing the effects produced by the use of spruce fir by the use of degelatinised bone meal and superphosphate.

The experiment field was divided into 3 lots. The first year one lot received superphosphate at the rate of 535 lbs. per acre, the second lot 535 lbs. per acre of degelatinised bone meal, while the third lot was irrigated and served as a control. The plots were then sown with spruce seedlings.

During the second year the same treatment was repeated and the young plants appeared some days afterwards. They were subsequently measured at regular periods of growth.

The experiments showed that during the first year of growth, the superphosphate had a better effect on the young spruces than the degelatinised bone meal.

During the second year, there was less difference in the effect of the fertilisers in the case of damp soils. Where the rainfall had been abundant during the growing period, the superphosphate had less effect than the bone meal. The reverse, however, occurred in dry soils.

LIVE STOCK AND BREEDING.

Dr. Chalcid *Hunterellus Hookeri* Parasitic on the Tick *Rhipicephalus sanguineus* in Rio Janeiro, Brazil. — Dr. COSTA, LUIZ, A. (Antonio).

Revista do Serviço de Medicina Veterinária do Ministério da Agricultura, Applied Branch of the Ministry of Agriculture in Ministério da Agricultura, Conselho Nacional de Veterinária, Zoológico, Year V, No. 1, pp. 201-203, 1915, 12 plates. London, August 1915.

The author collected adult individuals and pupae of the tick, *Rhipicephalus sanguineus*, from a dog. The adults furnished no parasites, while on the other hand as many as 11 specimens of *Hunterellus Hookeri* Howard were obtained from one pupa. The presence of this hyperparasite had already been noted in Mexico. In addition to attacking the pupae of *R. sanguineus* the parasite on those of *Dermacentor parumpertus marinus*.

Contribution on the Use of Sugar as a Dressing in Veterinary Surgery. — Dr.

GIACCHINI, Laboratory of Clinical Surgery of the Royal Veterinary High School, Università veterinaria, Year XXXVIII, No. 10, pp. 366-373, Nov. 20, 1914, No. 21, pp. 425-431, Plate 6, Milan, October 17, and November 16, 1914.

The author gives a summary of the present knowledge of the use of sugar in surgery and its physiological properties (absorbant, antiacid, healing, trophic) and a description of his own observations and experiments.

In these experiments sugar or glucose was used alone without the aid of antiseptic, and applied to sutured or other wounds, especially in operations on the feet. Experiments were also made with injections of solution of glucose in the abdominal cavity, under the skin, in the trachea and jugular vein. Horses and mules were used for the experiments.

The general conclusions are as follows:

A) Solutions of glucose 5 to 10 per cent injected under the skin in the abdominal cavity and joints of the animals under experiment are absorbed in a short time and without any disturbance other than a slight rise in temperature.

More concentrated solutions (25 per cent) at a temperature of 30° may be injected in the horse in the trachea and jugular vein with the double advantage of being more rapidly absorbed and easily absorbed. From 500 to 1000 cc. may be injected daily without leading to any disturbance in the functions of the larger organs and by repeated injections for several days in succession a considerable improvement in the general condition of the animal is obtained. On this account the use of sugar may be used advantageously in place of physiological saline.

The solution may be made either with distilled water or with physiological solution by dissolving 250 grams of sugar in 1000 cc. of solution.

B) Powdered sugar applied to any wound acts as an absorbent, antiseptic, and at the same time stimulates the nutrition of the tissue, leading to the formation of a granular layer over the wound leading to more rapid healing.

C) Sugar applied directly on sutured wounds protects them from possible infection because it initiates rapid healing.

D) In foot operations generally accompanied by more or less considerable loss of matter, and especially in the partial or total separation of the hoof, dressings of sugar by rapidly cleansing the wound promote the growth of horny tissue invariably visible in 12 to 15 days after operation.

E) Since the sugar has the advantage of being a powerful deodorant it eliminates the disagreeable odour from the instruments soiled with pus and discharges from the wound. This is particularly advantageous in operations producing a nauseous odour such as that of cancer of the foot. The use of sugar gives rise to a smell not unlike that of the alcoholic fermentation of musty grapes.

F) With dressings of sugar the formation of pus seldom occurs, even with solutions moderately dilute and applied to a discharging or discharging wound. After contact with the sugar the discharge from the wound diminishes and ceases with successive applications. When properly applied the dressings may remain in position from 8 to 10 or even 12 days without inconvenience.

G) Sugar may be used either solid or in solution without any special preparation. It is therefore very useful and practical not only on account of its low price but because of its always being readily accessible in all cases wherever they may occur.

H) Although therapeutic properties are common to both of the

to glucose the writer recommends the latter in preference on account of its lower price and more suitable physical character, being in the form of a very fine powder it adheres more readily, forming a very thin and compact layer.

Being absorbant, antiseptic and healing properties sugar constitutes a dressing of the first order which may render great service in veterinary surgery, especially in private practice, in place of ordinary antiseptic dressings.

Contribution to the Study of Trypanosomiasis in Animals in Angola, West Africa.—MONTENHO DA COSTA ANTONIO in *Revista de Medicina Veterinaria*, Year 14, No. 233-236, Lisbon, October, 1915.

The writer shows the presence of trypanosomiasis in cattle at Huambo and identifies the species as *Trypanosoma congolense*.

On the Immobility of the Anthrax Bacillus.—CARPANO, MARCO in *Il Moderno*, Series V, Year IV, No. 11, pp. 149-152, Bologna, November 30, 1915.

Many works on bacteriology affirm that *Bacillus anthracis* is absolutely immobile. Some writers (TOUSSAINT, NICOLLE and TRESEL DUFOUX) have shown the contrary.

The writer has studied this question at the Army Veterinary Bacteriological Institute at Rome using Pasteur first and second vaccines and examining the material fresh and staining the cilia.

He found that: 1) in a tenured forms (vaccine) and in virulent forms (fresh) in special media (of a nature ill adapted to its growth) the bacillus in the first few hours of its growth may exhibit limited but appreciable movements due to the presence of peritrichial cilia; 2) this bacillus may therefore be classified more closely with the other group of anthrax bacilli showing more or less quick movements.

The Diagnosis of Glanders by Means of Coagulation Tests.—MARGIS, ÁRPÁD in *Orvosi Hetilap*, Year XXXVIII, No. 37, pp. 239-241, No. 38, pp. 245-247, Budapest, 1915.

According to the experiments of EHRLICH and SACHS fresh blood serum of cattle destroys the red corpuscles. BORDET and GAY have shown that serum coagulates the corpuscles before destroying them. The serum is rendered inactive by warming on a waterbath at 56° C. for half an hour (it destroys the complement). On adding the serum of fresh horse's blood the inactive serum it recovers its original properties. BORDET and GAY therefore concluded that there exist in bovine serum thermostable bodies similar to amboceptors. BORDET has named them "*conglutinating*" their coagulating action "*conglutination*". Recently STRENG has found that bovine serum is also capable of "*conglutinating*" bacteria.

These preliminary experiments suggested that this property of conglutination might be applied in serological work. KARWONEN, STRENG, and THORSEN and others have successfully applied this test to the diagnosis of syphilis, and LUGER has used the method in diagnosing typhus. In a few years it has gradually found more favour in the diagnosis of diseases.

PELLER and WEBER were the first to recognise the use of conglutination for diagnosing glanders and they recommended a very simple way of carrying out the test. The writer describes this method in which a horse is detected by the absence of conglutination in its serum. In the blood of infected horses there are anticonglutinins which prevent conglutination of the corpuscles in question. The presence of the conglutinin proves the absence of infection since the blood of healthy animals do not contain the specific substances preventing coagulation.

ANDERSEN, MICHAEL, SREXNIG have carried out several experiments on this method confirming its suitability as elaborated by PELLER and WEBER for determining infection by glanders.

The researches of MEISSNER and TRAPP have shown that the serum of healthy mules contains anticomplementary substances which more or less prevent the action of the complements. SCHUTZ and WILHELM have also shown that the fixation of complements is not a very reliable process for the diagnosis of glanders in asses and mules. After examining the blood of a mule artificially infected and the blood of several healthy mules they found that this method was of great practical value.

With a view to testing the value of this serum method, experiments have been begun at the Epidemiological Institute of the Royal Veterinary School at Budapest. During 1914 two horses were infected by means of a culture of *Bacillus mallei* obtained from 5 greyhounds. Before infection the blood of the horses was submitted to tests for agglutination, complement fixation, conglutination and precipitation, with negative results in all. The same tests were repeated each day after infection. The object of the experiment was to show: (1) the practical value of conglutination; (2) how long after infection the conglutination tests reveal the presence of infection compared with the period required by other tests.

According to the results of the first series of experiments the conglutination test indicated the presence of glanders 3 days after infection, whilst the fixation of complements test required 6 days and the conglutination test 8 days. Thus the agglutinins, the fixatives of the complement and the anticonglutinins require respectively 3, 6 and 8 days after infection to attain sufficient strength to reveal the disease. (One dose of 0.1 cc. of blood serum completely prevented the conglutination of the corpuscles.

In the 2nd series of experiments the precipitation test indicated the presence of the disease in 3 days after infection, whilst agglutination and complement fixation required 6 days and conglutination 9 days. Thus the specific antibodies formed in the blood of infected animals, the agglutinins multiplied fast.

In other experiments the sera of 24 horses with glanders, of 12 healthy horses and of one doubtful case were submitted to the conglutination test.

The serum of 20 infected horses in doses of 0.1 to 0.2 cc. prevented the conglutination of the red corpuscles, thus indicating the presence of infection. In these 20 cases the complementary fixation and precipitation tests gave a positive result once whilst the agglutination and conglutination tests always gave a positive result.

the serum of 26 healthy horses at the rate of 0.1 to 0.2 cc. caused agglutination, thus showing the absence of glanders. With the exception of two cases the agglutination, fixation of complements and agglutination tests did not succeed.

The conclusions drawn from these results are as follows.

The agglutination test of PFEILER and WENER may be used in the diagnosis of glanders. It has the advantage that all the necessary substances can be procured, viz: bovine serum and horse complement.

The antibodies forming in the blood of animals subject to glanders and agglutinins appear latest and remain longest.

The agglutination test requires a period of 8 to 9 days for signs of agglutination to appear.

Although spontaneous infection is more quickly detected by the agglutination method the writer considers it necessary to use also the other methods of rapid diagnosis.

The Virulence of Rinderpest in Cattle. -- CARPANO, MATTEO (Bacteriological Institute, Milan). In *La Clinica Veterinaria*, Year XXXVIII, No. 23, pp. 501-515, Milan, 1915, 12, 1915.

The more important researches on rinderpest are summarised and the main conclusions are drawn from the writer's own observations.

The blood of cattle infected either artificially or naturally may be virulent during the 4th period of the disease and at death.

In treating animals for the production of anti serum as well as serum (serum and blood) they should be chosen in the 2nd or 3rd period of the disease when the blood is certain to be infected.

Effects of Tick Eradication on the Cattle Industry of the Southern Areas of the United States. (1). -- WYCK, W. F. (Bureau of Animal Industry) in *Special Bulletin of U. S. Department of Agriculture*, 20 pp., 8 figs. Washington 1914.

This paper deals with the recent improvements in the cattle and pasture lands of the tick-free areas of the Southern States of North America and suggests methods of improvement which should be adopted as soon as ticks have been eradicated from any section. The most important of these are:

(1). Improvement of the pastures by the sowing of suitable legumes or grasses such as lespedeza and bur-clover (*Medicago arabica* Huds.) on the upland and alsike clover (*Trifolium hybridum*) white clover (*T. repens*) and *Stylosanthes dilatatum* on the bottom lands.

(2). The improvement of the cattle and gradual elimination of the inferior type by the use of good bulls of the beef breeds.

Cattlemen and farmers throughout the States in question are unanimous in holding to the advantages derived from the campaign organised by the United Animal Industry, whereby, in a period of 7 years, the tick has been eradicated from an area of 198,802 square miles, or from more than one-third of the whole area infected.

FEEDS
AND FEEDING

191 - Value of the Starch Equivalent System in Modern Feeding Practice.

J. ALLAN, University College, Reading: The Starch Equivalent Theory, in *Journal of Agricultural Science*, Vol. VII, Part 2, pp. 153-162. London, September 1911.
 H. HALLAN, E. F. Animal Nutrition Institute, Cambridge: The Maintenance of Oxen and The Starch Equivalent Theory, *Ibid.*, pp. 163-171.

In a previous paper (1) Wood and Yule have examined why British experimenters, calculating on the basis of Kellner, usually find that the increases produced by various diets are not proportional to the excess of starch equivalent provided by the diets required for maintenance. The publication of this paper has stimulated the above named authors not only to an examination of the point but also to a general discussion of the principles underlying the system of starch equivalents in the light of recent experience.

1. - It has hitherto been customary to assume that the requirements for maintenance of oxen were proportional to the live weights of the animal and could therefore be determined by rule of three, though it has been known that this is not true. Wood and Yule have discarded this notion and have determined the variation in the requirements of different sizes by means of a diagram which may be expressed mathematically by the formula:

$$\log E = \frac{2}{5} \log M + 1.16723$$

where M is the live weight of the animal and E is the amount of starch equivalent required for maintenance. In such a formula, however, it is assumed that the difference in live weight is due in all cases to greater or less growth and not to fattening. Fat animals require more food to maintain them without gain or loss of weight. In an attempt to meet this difficulty the writer suggests the introduction into the formula of a factor x , which is a number that varies inversely as the fatness of the animal. This assumes that some method is found to express the degree of fatness in numerical terms. All that can be said at present is that when animals are in store condition -- whatever that may be -- the value of x is 1, and, if they are fatter it is less than 1. Possibly it is the above factor that is concerned in the gradually diminishing returns in the shape of increase of food consumed as the animal grows fatter.

The writer considers that a ration comprising two or more independent variables, e. g. maintenance and fattening can no longer be calculated by a single arithmetical operation. Conversion of the nutrients into starch equivalents does not overcome the difficulty. The best results were obtained when the digestible nitrogenous and non-nitrogenous parts of the ration are supplied in the proportions and quantities required for each purpose, viz., maintenance, growth, work, fattening and lactation. The amounts required for maintenance depend upon the size of the animal, those for other purposes upon the rate of each kind of production. If, probably in no case are they directly proportional to that rate. If

(1) See B. Dec. 1914, No. 1147.

the nutrients must be derived from a food suitable for the particular purpose. Thus, the nutrients for maintenance of oxen should be derived from the coarse fodders and those for fattening from the finest, most digestible materials. Nothing should be deducted from the former for lack of digestion, etc. From the latter there is nothing to deduct for amount, or at least, with one or two exceptions, the amount to be deducted is insignificant. If, however, the amounts of nutrients for the two purposes are not to be added together but directly translated into corresponding amounts of appropriate kinds of food, it seems clear that the amount to be determined by a separate calculation in each case, and the simplicity of the starch equivalent system disappears.

The present feeding standards should be superseded by formulae which should be in terms of "total digestible nutrients" with given albuminoid for maintenance, growth, work, fattening and milk production. In the present state of knowledge such formulae could be little more than hypotheses they would serve to give point and direction to research.

It is interesting to note that the writers find it difficult to understand Murray's objection (see page 109 above cited) to Wood and Yule's distinction between starch equivalent for maintenance and starch equivalent for production, especially as Murray himself admits the error of applying the term "starch equivalent" promiscuously to essentially different things and clearly shows the impossibility of completely defining starch equivalent for maintenance and starch equivalent for production alone.

Kellner's starch equivalents were intended to be used solely for estimating the relative fattening capacities of various foods and were not intended to be applied indiscriminately for the estimation of maintenance and for the production of fat. The point is that the term starch equivalent in the sense used by Kellner is scientifically incomplete (1). Since the term "starch equivalent" is used for both "starch equivalent for maintenance" and "starch equivalent for production" it is this latter expression that should be employed. There would be no longer any danger of the starch equivalent for production of food being used to express the maintenance starch equivalent.

The formula proposed by Murray, although possibly more scientifically complete, will hardly appeal to a farmer who has already rejected Kellner's starch equivalent system on account of its complexity of application. The chief advantage of the Kellner system lies in the fact that it gives the comparative values and not the absolute values of feeding stuffs for fattening purposes. The farmer desires to know, not how much fat or milk he will produce, but rather which of several foods is more economical for the purpose he has in view. It has yet to be proved that the starch equivalent system is incapable of giving him the right information on this point.

⁽¹⁾ This terminology has recently been the object of criticism from another point of view. See Prof. Laur, *See B. Dec 1915, No. 1334*. (Ed.).

195. **Essential Factors in the Diet during Growth.** — Mc COLLUM, E. A. and MARGULIETH. Laboratory of Agricultural Chemistry of the University of Wisconsin. *The Journal of Biological Chemistry*, Vol. XXIII, No. 1, pp. 231-246, 1957, 1958, 1959, 1960, November 1957.

The results of previous workers, STEPP, HOPKINS, FUNK and others, favoured the theory that in addition to proteins, carbohydrates and salts there exist certain other accessory substances (at present unknown) indispensable for growth or prolonged maintenance. The writer's experiments afford additional support to this theory and show, further, that there is a class of such accessories soluble in fats and another class in water and alcohol.

While the amount of these accessory substances required for growth is probably small, the evidence points to the belief that a certain quantity must be present before any growth can take place, and that this amount grows in proportion to the amount of accessories present.

It is obvious that in the study of the relative values of isolates fed with mixtures of purified food substances comparable studies of these two classes of accessories must be supplied. Otherwise no interpretation can be put upon the results.

196. **Acidosis: Excess of Acids in Omnivora and Herbivora and its Relation to Protein Storage.** — SHENPOCK, H. NELSON, V. E. and HART, E. B. in *Researches on the Nutritional Experimentation Station of the University of Wisconsin*, 19 pp., 1958, September, 1958.

Emphasis is continually placed upon the balance of acid-forming elements in rations and upon the necessity of maintaining a excess of basic over acid radicals for normal nutrition. The part ammonia may play in maintaining tissue neutrality is, however, often disregarded.

Experiments were carried out with feeding acid rations to omnivora as represented by swine, and to herbivora, as represented by calves. A ration fed to the swine consisted of grain alone or of grain supplemented with a basal ration. That fed to the calves consisted solely of milk, the acidity of which was regulated by the addition of a mineral acid.

Acid rations fed to swine (omnivora) or calves (herbivora) occasioned a rise in urinary ammonia with a compensative fall in output of urea. Presumably, with normal protein intake, a part of the ammonia produced either in the intestine or liver, combines with acids and is excreted as salts of these acids. This power to help maintain neutrality by the excretion or use of ammonia is apparently very general in all mammals.

Ammonia production, under conditions of exogenous protein metabolism, does not occasion an increased nitrogen excretion or an increase in protein storage.

In herbivora (calves) approximate endogenous nitrogen metabolism likewise occasions a rise in urinary ammonia, without, however, (at least in amount of acid used), causing a rise in protein catabolism, as has sometimes been observed with dogs and swine.

Data are also given on calcium and phosphorus metabolism.

acid periods of low nitrogen intake, as well as on a period of high nitrogen intake. Only on a high acid ingestion did it appear pronounced decalcification of the bones began and that there was then a withdrawal of calcium carbonate.

From the results obtained it is believed that natural acid rations, if they are satisfactory, are as effective for growth or reproduction as those of a neutral character. Further evidence is needed, however, before making any definite conclusions.

Chemical Changes in the Intestinal Content from the Beginning of the Digestion to the Rectum. — MUSCHINI, DARIO DI E. *Mem. Zootec.*, Series V, Year IV, 1913, No. 12, 1913, Bologna, November 30, 1913.

The following points were investigated: 1) the quantity of water, total and soluble residue in the chyme of the different parts of the colon of ruminants (cattle and sheep); 2) the quantity of mineral matter in the various parts of the intestine of ruminants.

It was found that: 1) there is no digestion and absorption of proteins in the second half of the colon.

In sheep the maximum absorption of water occurs in the part of the colon between the small intestine and the sigmoid flexure, whilst in cattle between the spiral colon and the rectum.

There is no direct relation between the absorption of water and absorption of mineral matter; most water is absorbed in that part of the colon in which the absorption of salts is least.

The maximum absorption of mineral matter occurs in the first part of the colon.

The Composition and Food Value of the Seeds of Galium. — BERNÁSKY, JENO. Hungarian Seed Station, Budapest in *Kisföld és Késmenyek* Vol. XVIII, 1913, No. 1, 1913, Budapest 1913.

The siftings of wheat used as food for live-stock in Hungary, there are seeds of *Galium Aparine*, *G. Vaillantii* and *G. tricornis*. It is therefore interesting to know the food value of these seeds and also in what manner other species may be identified when the integument of the seeds is removed in the siftings.

The results of anatomical and analytical analyses on the above three species of seeds lead to the following conclusions:

1) The three species of *Galium*, *tricornis* is most abundant in the wheat siftings of Hungary.

2) The products of *G. Aparine*, *G. Vaillantii*, *G. tricornis* and *G. palustre*, the seeds or tufts of which are broken by the sifting can be identified analytically.

3) With the exception of *G. Vaillantii* the seeds of the other species of *Galium* may be identified even when they are deprived of their integuments. *G. tricornis* and *G. Aparine*, the two most important from an economic point of view, may be distinguished by means of their seeds.

4) The seeds of *Galium* may be considered as good food for cattle, but on account of their hardness they should be fed in a ground state so as to insure their digestibility. They may be fed to fowls without grinding.

The spiny hairs on the integument of the seeds of *G. Apollonii* and *G. Vaillantii* become broken in the sifting and therefore do not give rise to trouble in feeding. The seeds of *G. tricornis* are tufted rather than spiny.

In addition to the protein, carbohydrates and cellulose the seeds of *Galium* contain from 1 to 2 per cent of oil finely divided in the tissue, rendering its extraction and determination very difficult.

1999. **Calculation of the Percentage of Molasses in Molassine Feeds.** — *Die Landwirtschaftliche Versuchswissenschaften*, Vol. 87, No. 1, pp. 25-28, Berlin.

In Germany, the percentage of molasses contained in mixed cereals is calculated according to a formula devised by NEUBAUER (1) and based on a constant representing the weight of water soluble substances found in 1 gm. of the dry matter. Since sesame cake is often used as a top-dressing for the molasses it is important to know the value of this constant for different kinds of sesame cakes.

The following are the results of six kinds:

Cake No.	Percentage of water.	Specific Gravity	Value of Constant
1	0.27	1.00305	0.0541
2	0.09	1.00175	0.0512
3	7.45	1.00305	0.0618
4	7.03	1.00300	0.0631
5	5.61	1.00380	0.0647
6	7.00	1.00355	0.0630

The mean value of the constant is 0.057. The differences in the value of the constant are analogous to those found by NEUBAUER for pearl millet and maize germs. The relation between the percentage of fat and the constant has not yet been determined.

The average of the six constants only differs slightly from any one of the values and can therefore be taken as the constant for sesame cakes generally.

BREEDING

2000. **Observations on the Skulls of Hybrids between Wild and Domestic Horse Cattle.** — PHILIPSCHELENKO (189) (Zoological Station of the Ministry of Education, Odessa, Nova, Russia), in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. LXXVIII, No. 38, pp. 636-638, Paris, December 3, 1903.

The skulls of the following hybrids were studied: 1) hybrids between ordinary cattle and species of Bison, viz.: American bison (*B. bison*) and "zubr" (*B. bonasus*); 2) hybrids between horses and zebras.

In the first series were skulls of a halfbred "zubr" ($\frac{1}{2}Z$) and of a halfbred bison ($\frac{1}{2}B$) of a halfbred bison ($\frac{3}{4}B$) and of a $\frac{1}{4}$ bred bison ($\frac{1}{4}B$). For purposes of comparison the skulls of the following were measured: a "zubr" (Z), a bison (B), a bull and a cow of the Ukraine breed (U) to which the mothers of all these hybrids belonged.

In the second series are the measurements of the skulls of two hybrids obtained by crossing *Equus chufiniani* with the horse ♀ ($\frac{1}{2}Z$).

(189) H. NEUBAUER in *Die landwirtschaftlichen Versuchswissenschaften*, Vol. 81, p. 421, 1901.

For comparison the skulls of the male zebra (Z) used as male parent and of the bison (B) and of a horse of the local breed (H).

The most characteristic measurements are given in the form of ratios in the following table for the bison hybrids:

	B	Z	$\frac{1}{2}Z$	$\frac{3}{4}B$	$\frac{1}{4}B$	$\frac{1}{8}B$	H
	♂	♂	♂	♂	♂	♂	♂
Height of skull	31 $\frac{1}{4}$	38 $\frac{1}{4}$	32	35 $\frac{1}{2}$	33 $\frac{1}{2}$	32 $\frac{1}{2}$	30 $\frac{3}{4}$
Rostral length	41 $\frac{3}{4}$	21 $\frac{1}{2}$	22 $\frac{3}{4}$	27	24	29 $\frac{1}{2}$	32 $\frac{1}{2}$
Length of temporal fossa	96	122 $\frac{1}{2}$	117	91	110	11 $\frac{1}{2}$	95 $\frac{1}{2}$
Length of premaxilla	10 $\frac{1}{2}$	31 $\frac{1}{2}$	31	29	25 $\frac{1}{4}$	23 $\frac{1}{2}$	21 $\frac{3}{4}$
Length of nasal bones	19 $\frac{1}{2}$	31 $\frac{1}{2}$	31	29	25 $\frac{1}{4}$	23 $\frac{1}{2}$	21 $\frac{3}{4}$
Length of muzzle	57 $\frac{1}{4}$	83 $\frac{1}{2}$	70 $\frac{3}{4}$	76 $\frac{1}{4}$	72 $\frac{1}{2}$	70	61 $\frac{1}{2}$
Length of temporal fossa	96	122 $\frac{1}{2}$	117	91	110	11 $\frac{1}{2}$	95 $\frac{1}{2}$
Length of premaxilla	10 $\frac{1}{2}$	31 $\frac{1}{2}$	31	29	25 $\frac{1}{4}$	23 $\frac{1}{2}$	21 $\frac{3}{4}$
Length of nasal bones	19 $\frac{1}{2}$	31 $\frac{1}{2}$	31	29	25 $\frac{1}{4}$	23 $\frac{1}{2}$	21 $\frac{3}{4}$
Length of muzzle	57 $\frac{1}{4}$	83 $\frac{1}{2}$	70 $\frac{3}{4}$	76 $\frac{1}{4}$	72 $\frac{1}{2}$	70	61 $\frac{1}{2}$
Distance between intermaxillary							
and nasal bones . . . mm	6	44	38	8	39	7	8
Distance of occiput							
to rostral length	37 $\frac{1}{4}$	28	29	21	21	21 $\frac{3}{4}$	35

The above ratios show the blending of characters in the hybrids and depending more or less to the quantity of wild blood.

There is however a slight tendency to segregation and with regard to the character there is complete resemblance between the quarter and half hybrids. Possibly this is a case of combination of blending and of the inheritance, which would also result from the general conformation of the hybrids.

With regard to certain characters (3-4-5) the half-bred "zubr" is distinct in the half-bred bison although the pure bred wild forms resemble each other.

In some cases of halfbred "zubrs" the characters of the ordinary bull are dominant over those of the "zubr" and in other cases the contrary. The half-bred bison however appears intermediate in form between the wild and domestic parents. This may be accounted for by the varying quantity of the "zubr" characters and perhaps by the occurrence of segregation in the first generation as already noticed in other species.

Cranial Measurements of Zebroids.

	11	$\frac{1}{2}$ Z	$\frac{1}{2}$ Z
	σ^7	σ^8	σ^9
1) Basal Length mm	545	594	531
2) Posterior part of base of skull: Length of palata	$83\frac{1}{2}$	85	$80\frac{1}{2}$
3) Length of space without teeth: Length of row of teeth	70	$54\frac{1}{4}$	$60\frac{1}{4}$
4) Ocular index, NIEHRING	105	105	$104\frac{1}{2}$
5) FRANK'S index	$98\frac{1}{2}$	$98\frac{1}{2}$	100

With regard to the general size of skull the zebroids take an intermediate place between the parents. Several other measurements have the same character, e. g., the basal length.

In certain ratios (e. g., 2 and 3) there is a dominance of the horse over others of the zebra. Also, there is a resemblance to segregation (as in the stripes) when corresponding characters in the two animals are considered. This occurs in the case of the indices of NIEHRING and FRANK in the zebroid male which are the same as in the horse. In the female they are pronouncedly zebra in type.

Thus the inheritance of skull characters shows the usual course found in hybrids between species. For a more complete elucidation of this inheritance special investigation on more favourable species is necessary.

204 **Researches on the Transmission of Epilepsy in Animals.** BROWNE.

Prace Lek. Tow. Nauk. Warszawski, Year 30, Vol. 31, pp. 311-350, 1913, 16 p., 11 figs.

The theory of the transmission of acquired characters is based mainly on BROWN-SERGEANT'S experiments on the transmission of epilepsy induced by a spinal lesion. As these experiments have been considered much subject to criticism they have been repeated on a large scale by SIKORSKI and MACIEJKA of Cracow. In these experiments 123 guinea-pigs were used. They were narcotised by means of alcohol, ether or chloroform before wounding the spinal cord at the last dorsal vertebra.

The following results were obtained:

1) It is impossible to induce complete epilepsy in all guinea-pigs by wounding the spinal cord. When complete epilepsy is obtained the animal generally succumbs to the repeated nervous attacks, but in some cases the attacks subside after a time.

2) Lesion of the cord due to pricking brings on the epilepsy much later than that induced by cutting, in which latter case the female is epileptic quicker than the male.

In many animals lesion of the cord by pricking results in the formation of the posterior extremities of abscesses resembling those caused by the lesion of the ischiatic nerve.

Cases of complete epilepsy do not show this disturbance.

In several guinea pigs the epileptic attacks occurred immediately after operation. The writer considers that these cases are due not to operation itself but to the effects of the narcotic used.

The guinea pigs of epileptic parents (one or both) suffered more often the attacks of epilepsy after lesion of the cord than did their parents.

In one case was the epilepsy transmitted to the offspring, thus contrasting the experiments of BROWN SEQUARD.

Herd Books of the Argentine Rural Society. *Anales de la Sociedad Rural Argentina*, Vol. XLIX, pp. 425-427, Buenos Aires, September-October 1918.

Two adjacent tables give a summary of the entries in the herd books of the Argentine Rural Society since its foundation and a detailed account of them. All the pure breeds of cattle, horses, sheep and pigs produced or brought into the Argentine are included.

A. — Argentine Herd Book.

Breed	Entries 1st October 1914 to 30 September 1915				Entries since its foundation		
	Imported animals		Animals born in the country		Imported and native animals		Total
	Males	Females	Males	Females	Males	Females	
Argentine cattle	218	81	3 755	3 571	40 860	44 102	85 022
Argentine horses	3	—	583	639	8 016	10 238	18 284
Argentine sheep	9	—	365	356	3 391	3 756	7 150
Argentine pigs	—	—	—	1	130	180	310
Welsh cattle	—	—	11	8	86	160	186
Argentine cattle	—	—	4	2	14	18	32
Argentine horses	—	—	10	4	23	29	52
Argentine sheep	6	18	95	411	—	429	533
Argentine pigs	236	99	4 826	4 992	52 657	58 921	111 578

B. — Argentine Stud-Book.

Breeds	Entries from 1st October to 30 September 1915		Entries since 1st October 1915	
	Males	Females	Males	Females
Percheron	251	312	2 025	5 101
Clydesdale	137	221	1 697	4 472
Shire	107	206	1 485	3 633
Hackney	177	204	1 617	2 511
Yorkshire	28	53	236	95
Anglo-Norman	10	20	175	62
Suffolk Punch	4	11	167	41
Hunter	6	23	126	12
Boulonnaise	9	13	81	10
Orloff	4	7	49	13
Polo-Pony	4	3	54	6
Belgian	3	4	19	9
Oldenburg	2	2	9	2
Shetland-Pony	1	3	9	1
Holstein	—	1	9	11
American Trotting	—	—	3	1
Trakehnen	—	—	3	—
Totals	743	1 092	7 759	17 490

C. — Argentine Flock-Book.

Breeds	Entries from 1st October 1914 to 30 September 1915						Number of flocks on 1st October 1915 (including imported at the sale)		
	Imported animals		Animals born in the country		Provisional register		Definite		Total
	Males	Females	Males	Females	Inspected	Presented	Males	Females	
Lincoln	98	5	2 383	2 730	1 035	1 032	1 886	8 186	10 121
Merino, Argentine	—	—	891	1 150	—	—	1 218	2 504	3 722
Shropshire Down	8	—	38	80	—	66	41	182	230
Oxford Down	11	—	20	19	40	350	30	161	231
Rouney Marsh	0	80	20	23	163	90	41	88	234
Hampshire Down	2	—	80	118	91	166	103	318	511
Bordei Leicester	—	—	10	12	—	—	—	—	22
Leicester	1	8	11	4	—	—	—	—	23
Total	129	93	3 468	4 148	1 332	2 544	3 313	11 822	15 135

While the average price of the Jersey has declined \$41 in the last 10 years, the average price of Holsteins has gone up \$70.

The Guernsey and Ayrshire sales have been so few that it is not possible to make any comparison between their average prices and those of the other breeds.

For 1915 it seems as if the prices of Holsteins have advanced more than in any other year. In the first sale of the year 173 animals were sold for an average of \$866, and 10 animals sold for prices exceeding \$1,000. Another indication of the popularity of a breed is the number registered by the different breed associations. There were 21,060 Friesians registered in the last year, 9,944 Jerseys and 3,839 Guernseys. There are now approximately over twice as many Holstein grades in the United States as of any other breed, while in 1898 the Department of Agriculture estimated that there were 50 per cent more Jerseys than Holsteins in this country.

SHEEP

294. — **Features of the Sheep Industries of the United States, New Zealand, Australia Compared.** — MARSHALL F. R. (Senior Animal Husbandman in Charge, Goat Investigations, Animal Husbandry Division) in *United States Department of Agriculture, Bulletin* No. 313, 35 pp., 8 plates. Washington, D. C., November, 1914.

In addition to forming a general survey of the sheep industry in Australia and New Zealand the paper discusses the various points of divergence between the industry in those two countries and the United States with the object of affording comparisons useful to the American husbandman.

Sheep husbandry in New Zealand.

In comparison with American farm flocks, those of the smaller holdings in New Zealand have an advantage in that they rarely number less than 400 head and are a very important if not the chief source of revenue to the holdings. The following table contrasts N. Z. figures with those of the farm-sheep State and the leading range-sheep State in U. S. A.

Sheep in New Zealand, Ohio and Wyoming.

State	Total	Sheep	Holdings	Holdings	Average
	land area	in State (1)	over 100 acres (2)	having sheep (3)	number (4)
	Acres	Number	Number	Number	Number
New Zealand	66,292,232	24,595,405	25,702	21,527	1,142
Ohio	29,073,600	3,293,000	94,754	71,556	46
Wyoming	62,459,160	4,472,000	9,584	1,643	280

(1) Jan. 1, 1914. (2) In 1910.

though it is partly of necessity that New Zealand lands are so largely devoted to sheep raising the place occupied by sheep is evidence of the profit obtained when valuable lands are devoted to well managed flocks of moderate size to ensure careful tending. The advantage enjoyed in N. Z. in the price of wool is largely due to the superior skill in preparing clips for the market. The main difficulty in the way of an improvement in the price of the Middle and Eastern States of U. S. A. is lack of appreciation of the benefits obtainable from carefully tended flocks.

Sheep husbandry in Australia.

Table II compares the size of holdings and of flocks in New South Wales and Victoria with those of the Western United States.

Table II. N. S. Wales, Victoria and the western part of the United States.

Region	Total area	Total area	Per cent	Area	Total acres
		owned	of area	under lease	in holdings
		(Farms)	having	or license	over 100 acres
		is inches	rainfall or less		
	Acres	Acres	Per cent	Acres	Acres
N. S. Wales	198 051 420	57 818 023	39.0	124 590 163	181 195 753
Victoria	56 245 760	31 055 920	37.0	11 413 191	41 502 918
W. Mountain States	398 599 680	47 016 780	72.0	—	45 155 275
Western States	319 175 040	124 951 701	15.0	—	113 281 343
U. S. States	204 580 800	57 328 780	37.0	—	48 027 762

Region	Total sheep	Sheep per acre	Number	Average	Sheep
		on holdings	of	size	in flocks
		over 100 acres	flocks	of flock	over 1000
	Number	Number	Number	Number	Per cent
N. S. Wales	38 855 891	0.21	24 549	1 520	84.5
Victoria	11 802 224	.25	24 838	480	59.7
W. Mountain States	18 196 574	.305	11 323	1 607	86.8
Western States	6 382 426	.050	11 881	537	80.6
U. S. States	5 592 107	.116	11 368	452	80.7

In Australia the flocks are not kept collected under the care of herders and mustering but the lands are fenced into "paddocks" of from 500-1000 acre in size. The labour and expense required by this method is more

than counterbalanced by subsequent saving in the labour of handling the flocks and in the extra thrift of the sheep.

Tenure of grazing lands.

In large part the success of the Australian pastoralist depends on the system under which he holds his grazing lands. The Australian pastoralist who pays for the use of his lands according to a long time lease is at a great advantage over the American pastoralist who argues for an investment in improved stock or in the appliances and intelligence required to secure a good reputation for his product cannot be safely attempted because of the uncertainty of his remaining in business long enough to reap the profits. A definite policy for control and improvement of the grazing lands is urgently needed in America.

Breeds and Types of Sheep in Australia and New Zealand.

A point of considerable interest is the divergence of Australian and American Merino standards. Australians are said to be familiar with the so-called "Vernon" sheep and the use of that blood has been continued. Both are derived from the same original stock. Objecting to the excessive wrinkles on the body, to excess of oil in the wool, to shortness and too great fineness of the wool. These features are considered to be indicative of a lack of constitutional vigour. Considerable space is given to the consideration of Australian standards.

As regards carcass value the American Merino is not inferior to the Australian Merino in either size or points of mutton conforming to the both regards the latter is inferior to the Rambouillet as bred in the United States. This latter breed is little known or understood in Australia.

Attention is drawn to the huge prices paid for stud sheep in Australia. These are made possible by the patronage of a large number of owners of big commercial flocks who know that \$500 or \$1000 invested in an exceptional ram is more than returned in the fleece values of the number of sheep tracing descent to such a ram in a few years.

The use and popularity of the mutton breed in Australia is increasing. The Lincoln, Border Leicester, Leicester and Roman Leicester breeds are all in demand. The Cotswold is little known. The down breeds are favoured most by those who market their lambs before they are a year old and of these only the Shropshire and Southdowns are widely bred.

The Corriedale is gaining ground in Australia and is still comparatively new in the South Island of New Zealand where it was first produced. It was to study this latter breed with a view to a trial importation to America that the writer visited New Zealand. The breed's greatest assets of usefulness in U. S. A. is for those localities which need and can afford sheep of more carcass development than the Merino and in which the latter is to be relied on for at least one-half of the flock income. The ex-

which the U.S. Bureau of Animal Industry will conduct with the object of determining (1) the ability of the goat (not considered under the term "paddock system") its ability to thrive on various types of western feed, and the extent to which it can impress its features upon the offspring reared in the section where such a type as the Corriedale seems to be best adapted.

Shearing and Wool Classing.

The practices of American and Australasian wool growers differ more in the handling of the shorn wool than in any part of their work. In the United States the wool is not infrequently sold before it is shorn. When this is not the case the sheep are not sorted for shearing and the entire fleeces are sacked just as they run. In disposing of the wool there is no possibility of fixing a price upon the amount of each of the various classes of wool in the sacks but bargaining must be done upon the basis of the clip as a whole.

Probably all the Australian and New Zealand wool remains the property of the grower until sold to the manufacturer. The cost of actual shearing constitutes only about one-half of the amount expended in preparing the wool. The Australian system of shearing, classing and marketing is discussed at length and the possibility and advisability of the introduction of such a system in the United States.

The paper concludes with references to the Co-operative shearing in New Zealand, Agricultural Education in Australia, Sheep-raisers' Associations, etc. As regards the influence of the possible future development of the Australian mutton and wool industry on the American market, the reason for anticipating an increase in these products reaching the United States sufficiently large to affect seriously market values.

ancestry of the Goat — *The Journal of Heredity*, Vol. 6, No. 11, pp. 518-521, 1915. (Nov., D. C. November 1915).

The domesticated European goat can trace his pedigree back to a single species, but not the combination of a number of distinct species as is the case with the horse, the ox, the dog etc. The first goat fossils are found in Pliocene Tertiary deposits in the Punjab and the Siwalik hills of India and are species allied to those now living in the Himalayas. In the succeeding Pleistocene epoch, remains of an ibex, one of the best-known wild goats, are found in the plains of Central Europe.

The distinction between sheep and goats was thus made at a comparatively geological period and even now it is not a broad one and it has been recently proposed to consider them as a single genus.

The question whether the two species breed together and result in offspring has received contradictory answers; it seems fair to say that interbreeding of the sheep and goat if it exists is at least very rare, and that the different species of wild and tame goats interbreed freely and produce perfectly fertile progeny. Hence from a phylogenetic point of view sheep and goats are to be considered as two distinct genera.

The goat genus *Capra* is generally credited with a dozen species, of which *Capra hircus aegagrus* (Bezoar, Pasang or Grecian Ibex) is commonly regarded as the ancestor of European, and thence American, domesticated goats.

Once common throughout Greece and Asia Minor, it still lives on some of the Mediterranean Islands, notably on the slopes of Mount Ida. Its habitat today is Persia, Afghanistan and Beluchistan and in the mountains of Asia Minor. The Pasang is easily domesticated and its first domestication probably took place in Western Asia, thence it was carried into Africa where it has departed very widely from the original type. One can say with confidence whether it was from Asia or from Africa that it was introduced into Europe. Its remains are abundant in the early period of the Swiss lake dwellings.

The goat of the Swiss lake dwelling was somewhat smaller than the modern animal and had horns. In the Bronze age the goat seems to have been larger than in the Stone Age. In the Roman period a distinctly new type appears, unquestionably the result of conscious breeding and artificial selection and closely resembles some of the types still to be found in Switzerland.

With the spread of the breeding of goats in many lands a number of different changes have been produced in their appearance, among which one of the most important was the disappearance of the horns. Breeds have encouraged variations especially in two directions: to improve the yield of milk and to improve the yield of hair. The best milk breeds have been obtained in Switzerland (Saanen and Toggenburg) while the best hair breeds are those of Asia Minor (Angora).

The number of goats under domestication in the world is estimated at 80,000,000 of which 20,000,000 are in Europe. From the most distant past the goat has been the "poor man's cow" and has been replaced by the cow with the increase of prosperity. In the United States, with the exception of the large Angora herds in the western States, goats are generally kept only in small herds.

2006. **Fecundity and the Relation between Male and Female Descendents in Improved German Pigs.** MACHESON, A., in *Berliner Tierärztliche Wochenschrift*, Year 1915, pp. 880-882, Berlin, November 28 1915.

The writer set out to determine:

- 1) The fecundity of the improved German pig during its sexual life.
- 2) The ratio of males to females in the various litters.
- 3) The influence of the number of young at a litter on the ratio of males to females.
- 4) The influence of the period of birth on the number and sex of the young.

For the purpose he studied the Herd-Book of the Breeders' Society of the Duchy of Brunswick where the improved German breed is bred. A total of 3,161 off-spring were studied with the following results:

- 1) The average number per litter is 9.50, the maximum number being reached at the 4th litter. A larger number may sometimes be

7th and 8th litters but only in the case of sows of exceptional

fecundity the first litter of a young sow generally contains more males than females. In the later litters there are more females. Generally after the 4th litter the females predominate.

In 40 litters (12.8 per cent of those studied) the number of young per litter was 10 or more; in 181 litters (50 per cent) it was less than 10; in 135 litters (37.2 per cent) it was greater than 10. The number of young per litter influences the sex in the sense that in small litters there are more males and in the larger ones more females.

The best periods for births are: February, November, January, and October. During the cold period September to March the fecundity is lower (9.7 per litter) than in the warm period during the rest of the year when it is 9.4 per litter. In accordance with the observations already made by WILCKENS, FRÖLICH and GEORGIS, more females were born during the cold period than during the warm period.

The Physiological Relationship between the Yellow Pigment of the Hen and the Xanthophyll of Plants. — PALMER, LEROY S., Dairy Chemistry Laboratory, University of Missouri, Columbia, in *The Journal of Biological Chemistry*, Vol. XXIII, No. 1, pp. 1-10, 1 plate, 3 tables. Baltimore, Md., November 1915.

The pigmentation of the egg-yolk and of the body fat of poultry is a matter of much practical importance to the trade, and the yellow pigment characterising the skin of hens has been shown to be of considerable value in judging egg-laying activity. Experiments were carried out in order to obtain definite evidence of a physiological relation between the plant xanthophyll and the natural egg-yolk pigment, such experiments finding practical application in the control of the colour of the flesh of fattening poultry, the control of the amount of natural pigment deposited in the egg-yolk. The natural pigment characterising the egg-yolk, body fat, and blood serum of the hen is physiologically identical with the carotin and xanthophylls of plants, with the latter class of pigments present in by far greater proportion. This is different from the utilisation of the plant natural xanthophylls by the cow, where the carotin is the predominant pigment found in the milk fat, body fat, and blood serum. Feeding egg-laying hens in which the pigment of the feed was carotin to the exclusion of xanthophyll were without appreciable influence upon the yellow pigment carried by the blood serum and deposited in the egg-yolk. The feeding of rations relatively free from both carotin and xanthophyll to laying hens resulted in a marked reduction of the amount of this pigment carried by the blood serum and deposited in the egg-yolk.

Measurement of the Winter Cycle in the Egg Production of Domestic Fowl.

By RAYMOND, (Biologist, Maine Agricultural Experiment Station) in *Journal of Agricultural Research*, Vol. V, No. 10, pp. 129-137, 8 tables. Washington, D. C., December 6,

The writer has previously shown that there are to be distinguished developments in the egg-laying activities of the fowl, the most striking of which

are those of winter and spring. As a measure of the winter cycle of productivity is taken the record of production up to the first March, since the individual's birth. The point now arises whether a better measure of the winter cycle of productivity might not be obtained by using the production of a bird up to the time it has attained a definite age, since the production up to, say, 300 days of age of the bird will include the winter cycle and will also allow for differences in the time of hatching.

The statistical evidence presented in the present paper shows that whatever superiority there is of one of these measures over the other is entirely in favour of the production to March 1; that is, with flocks of birds having average hatching dates falling somewhere within the month of March. It results, therefore, that the use, in investigations on fecundity, of the production of egg production to March 1 of the pullet year as a measure of the winter cycle of production is fully justified.

2004. **Poultry Breeding.** STODOL, ROSE R. (Scientific Assistant in Poultry Breeding, United States Department of Agriculture, Washington, D. C.) in *Transactions of the American Society of Animal Production*, Vol. VI, No. 11, pp. 453-457, 3 plates. Washington, D. C., November 1910.

This paper is a summary of the results obtained in the extensive breeding work which has been carried on in breeding poultry in the last twenty years, and a discussion of their value for practical poultry keeping.

Following the rediscovery of Mendel's laws in 1900 there has been and has since been continued a considerable deal of experimental work on the heredity of characters in poultry. The first work along this line was done by WILLIAM BYRSON, in the United States the Carnegie Institution's Department of Experimental Evolution at Cold Spring Harbour, Long Island, N. Y., under the direction of C. B. Davenport, has been especially active along these lines. These studies have justified the conclusions reached by Mendel, that in poultry the transmission of characters agrees with the theoretical Mendelian laws, that certain characters are inherited in a manner as sex limited and that the dominance and recessiveness of these characters of poultry are those given in the accompanying table.

As will be noted from this table, in only a few cases is dominance as complete. A fact worthy of attention is that in the Andalusians the black nor the splashed white shows dominance over the other but they exist side by side in the hybrid in a minute mosaic, which causes the blue colour. The blue individual is therefore always heterozygous for the black. Recent studies show that the character "bare-neck" is dominant over "feathered neck".

One of the best-known examples of sex-limited inheritance is the barred colour pattern of the Barred Plymouth Rock. In order to explain this according to Mendel's laws, the female is considered to be heterozygous both for sex and for barring, while a repulsion is assumed between the determiners for these two characters, which prohibits their coming into the same gamete. The male is considered to be homozygous dominant for sex and either homozygous or heterozygous in respect to barring, the females therefore inherit barring from their sire alone. A number of different crosses have been made which support this hypothesis.

Fig. 10.—The Mode of Inheritance of Some of the Common Characters of Poultry.

		Recessive		Remarks
Black	White (Leghorn)	Black, red, buff		Almost complete dominance
Black	Buff	Recessive white (Minorca)	+	+
Black	Blue (Minorca)	Red, buff (Wyandotte)	+	+
Black	Orange pattern	Recessive white, black self colour	+	Sex limited inheritance
Black	Blue (Leghorn)	Recessive white (Minorca)	+	
Black	Blue (Minorca)	Hackle lacing (Brahma)	+	Imperfect dominance
Black	Feathering	Silky feathering	+	Complete
Black	Feathering	Normal repeat feathering	+	+
Black	Comb	Single comb	+	+
Black	Comb	Comblessness (Broda)	+	
Black	Crest	No crest	+	Imperfect
Black	Crest	Cerebral hornia (Polish)	+	
Black	Crest	Normal uropygium	+	
Black	Foot	+	+	
Black	Feathers	+	+	
Black	Feathering	mesoderm color	+	
Black	Feather colour	White skin	+	Complete
Black	Shank	Light shank	+	
Black	Shank	+	+	
Black	Shank	Brown, red, pearl iris	+	
Black	Shank	White ear lobes	+	Imperfect
Black	Shanks	Clean shanks	+	
Black	Shank	Vulture hock (Silky)	+	
Black	Silky	No hooting	+	
Black	Beard	No beard	+	Almost complete dominance
Black	Beard	Normal tail	+	Imperfect
Black	Feathering	Slow feathering	+	Almost complete
Black	Silky	Non broodiness	+	

Not limited in Brown Leghorns and Silky crosses.

1938. Barred Plymouth Rock; Cornish Indian Game \times Barred White Cochin \times Tosa; and Barred Plymouth Rocks with; Campines, Wyandottes, Wyandottes, Black Hamburg, White Wyandottes, and Plymouth Rocks.

Sex linkage has been reported in a number of other instances, such as sex being factor influencing the mesodermal pigmentation of the Brown Leghorns colour pattern, an inhibition for red in the plumage of the Columbian Wyandotte, the gray of the White Wyandotte and the colour on which high fecundity depends.

For about nine years, from 1898, systematic breeding experiments were conducted with the object of increasing the average egg production of the poultry. The results obtained led Dr. RAYMOND PEARL to hypothesize that the factor for high egg production behaves as a single character. According to this hypothesis the female is heterozygous and also for the factor of high fecundity and these two factors are present in the same gamete. This conclusion is based on the fact that high egg production is a unit character. But the results of experiments at the Utah Station do not confirm this conclusion and the results attained at the Massachusetts Agricultural Station indicate that high egg production is a compound, not a single trait (1).

210 - **Outdoor Wintering of Bees.** - PHILLIPS, E. F. and DEMUTH, GEORGE S. in *Journal of Agriculture, Farmer's Bulletin*, No. 665, 12 pp. Washington, D. C., October 1906.

The causes, variously assigned, of the death of individual bees in a colony of bees in winter, excluding unusual accidents, are capable of classification under two headings only: 1) inadequate stores, and 2) a

41. The following is a list of the United States Experiment Stations that deal with poultry and of the studies conducted by them.

Purdue University Experiment Station, Lafayette, Indiana: The influence of heredity on egg laying.

Kansas Experiment Station, Manhattan, Kansas: Study on the value of pedigrees for the improvement of groups of common breeds.

Maine Experiment Station, Orono, Maine: 1) Inheritance of fecundity and of egg laying. - 2) Mendelian inheritance of several plumage and other somatic characters. - 3) Inheritance of size of body and of size and colour of eggs. - 4) Interbreeding, - 5) of exterior agents on germ plasma. - 6) Heredity and the determination of sex.

Massachusetts Experiment Station, Amherst, Massachusetts: 1) Selection for egg production. - 2) Study on the fertility of eggs from the genetic point of view, - - 3) Inheritance of exterior characters of poultry.

Missouri Agricultural Experiment Station, Columbia, Missouri: Study of sex-linkage in the spotted plumage of the Hamburg breed and of the plumage of cocks that of the hens in the Sebright Bantam breed.

New Jersey Experiment Station, New Brunswick, New Jersey: 1) Inheritance of plumage. - 2) Heredity of several plumage and other somatic characters. - - 3) Factor of linkage in White Leghorn with single comb. - 4) Heredity of colour of egg shell.

North Carolina Experiment Station, West Raleigh, North Carolina: 1) Heredity of egg production. - 2) Heredity of colour of egg shell.

Oregon Experiment Station, Corvallis, Oregon: 1) Heredity of high egg production. - 2) Correlation between type and high fecundity. - 3) Crossing. - 4) Development of purpose-bred feggs and flesh.

Utah Experiment Station, Logan, Utah: 1) Study on the possibility of increasing egg laying by uninterrupted selection. - 2) Study on egg laying especially in connection with average winter production in comparison to average yearly production during first years of egg laying; b) limits of seasonal variation in the average egg production of a group.

Wisconsin Experiment Station, Madison, Wisconsin: 1) Experiments on inheritance of egg production. - 2) Study of the effect of lead poisoning of males on their offspring. - 3) Heredity of colour and other characters in pigeons.

protection. The remedy for the former is sufficiently obvious and

regards the second factor the authors have shown in a previous paper (*Dept. of Agriculture Bulletin* 93, 1914) (1) that at hive temperatures between about 57° and 69° F a normal broodless colony does not cluster but the bees remain inactive in the combs. The formation of the cluster only takes place when the air immediately surrounding the bees is 50° or lower. The bees in the centre then begin to generate heat by muscular activity, those at the periphery serving as insulators by crowding together. The lower the temperature of the air around the cluster the less amount of heat the bees are required to generate, till finally reached when the amount of heat produced and muscular activity become excessive and the bees may die. Or the high temperature of the brood rearing, a phenomenon always dangerous to the survival of the race. Further, the increased consumption of stores following inactivity results in an excessive accumulation of faeces within the colony, culminating in dysentery.

The locality in which the outer temperature falls to 40° F or below, insulation is therefore undoubtedly necessary.

The exact method of packing is not specially important provided insulation is given on all sides. A windbreak of evergreens is superior to any windbreak such as a house or solid fence. The best arrangement is to place the colonies in groups of four, two facing east and two west, in this way they will shelter on the same stand throughout the year. The practice of leaving the most unprotected and faced to the south, in order to utilise the heat of the sun, is not to be recommended. An entrance 8 ins. wide by $\frac{3}{4}$ in. is ample.

The time of packing is also important, delayed packing may cause far more damage than leaving the bees unpacked. Colonies which have wintered early need their insulation longest.

The Development of the Silk Glands in the Chief Races of Silk-Worms and their First-Crosses from the Point of View of the Quality and Length of the Reelable Silk from each Cocoon. — BRUET, PIETRO in *Le Stationi Sperimentali a varie distanze* XVI, III, Part 12, pp. 841-888, Modena 1915.

The following breeds and hybrids have been investigated :

1. Native pure yellow.
2. White Japanese.
3. Green Japanese.
4. Pure Golden Yellow Chinese.
5. White Japanese female \times native yellow male.
6. Yellow native female \times white Japanese male.
7. Golden Yellow Chinese female \times Yellow native male.
8. Yellow native female \times golden yellow Chinese male.
9. Bivoltine breed :

The experiments were repeated during 2 years (1914-1915) of which lead to the following conclusions :

The weight of the adult worms in the above races is from 6 to 10 times that of the silk-worm at birth. In crosses between native Japanese or Chinese breeds the adult worm is heavier when the mother is a female than when it is a male.

The following measurements were made :

Weight of two silk glands, total length of each (reservoir and excretory duct) ; the average weight and total length of each gland. It was found that the heaviest silk-worms had also heavier silk glands and apparatus. In crosses between yellow native female and white male the average weight of the silk-producing apparatus and glands was higher than in the reciprocal cross. The ratio between the weight of the worms and that of the silk producing apparatus is greatest in the Padma bivoltine breed, and least in the green Japanese breed, whilst it is relatively high in the Chinese breed (1:0.2576) and low in the crosses with the yellow native female than in the reciprocal cross. This ratio varies from 20 to 70 per cent and averages 25 per cent.

In all the races studied the reservoir is always longer than the duct, but in the golden yellow Chinese breed which has the greatest total length of gland the reservoir is shorter.

In the Japanese crosses there is little difference in the average weight of each gland but with respect to the average length of reservoirs and ducts with a yellow native female appears to show a slight increase in the ratio between the average length of an adult worm and the average length of the reservoir.

In the cross double yellow — golden Chinese female and white double yellow — yellow native female the above ratio is 1:1.487. The Chinese breed gives rise to a greater development in the mean length of each gland. The average length of the secretory channel is greater in the cross is made with the golden Chinese female than with the yellow native female.

The ratio between the length of the reservoir and the total length of the cocoon of silk in each breed is a minimum in the green Japanese (1:250.1) followed by pure yellow native breed (1:266.6). It reaches a maximum in the pure golden yellow Chinese race (1:379.3) and is 1.5 in the bivoltine Padma race. It is higher in the crosses with a female than in the reverse crosses and for both the foregoing it is higher than the native yellow parent.

In determining in the different breeds the absolute and relative weight of the empty cocoons and chrysalids it has been found that the native race increases the weight of the chrysalids in the hybrid breed in the cross yellow native female \times white Japanese male. The ratio of the chrysalid and the empty cocoon is generally greater in the cross native female \times white Japanese than in the crosses of the same native female breed and the golden yellow Chinese breed. This ratio is 1.2 in the bivoltine Padma breed and the green Japanese breed.

average weight of the empty cocoon is a maximum in the yellow native race and it is a minimum in the bivoltine race as in the white Japanese. The same may be said of the weight of the chrysalis.

The average ratio per cent between the mean absolute weight of a cocoon and the mean absolute weight of the empty cocoon is a maximum in the yellow native race and in the golden yellow Chinese race, 100% in the white Japanese female \times yellow native male and that of the golden yellow Chinese female and yellow native male this ratio is higher than in the reciprocal crosses.

In the hybrids, the yellow native race increases the weight of the cocoon and of the chrysalid as well as that of the worms, especially at the end of the rearing period.

It is found as was expected that the absolute weight of the reelable silk is higher in races with a greater absolute weight of empty cocoon, being a maximum in the yellow native race and a minimum in the bivoltine race. In the white bivoltine race the mean ratio per cent between the mean absolute weight of a normal cocoon and the mean absolute weight of the reelable silk is 100% and also the ratio per cent between the mean absolute weight of the empty cocoon and the mean absolute weight of the silk is very low, showing again how slight an advantage is obtained by rearing the bivoltine.

In the yellow native race, the worms are heavier as also are their silk-producing apparatus, their empty cocoons and their reelable silk.

In the first cross white Japanese \times native yellow female and in the second cross reelable yellow Chinese \times native yellow female, the average weight of the silk-producing apparatus, and the average weight of the empty cocoon and the average weight of the reelable silk are higher than in the reciprocal crosses. Thus, (this tendency to give greater weights of the worm, silk producing apparatus, empty cocoon and the silk is a true dominant character transmitted always by the female) greater intensity than by the male.

There is a correlation between the average weight of the worm, the silk-producing apparatus and the silk cocoon, since the races with the least weight (white and green Japanese and especially bivoltine) have also the least silk producing apparatus, empty cocoon and reelable silk.

The tendency to give a greater weight of silk is a dominant character in the native yellow race.

The lengths of the thread and the reelable silk of some races and hybrids are given in the following table:

The ratio between the average length of a worm at maturity and the average length of cocoon is never less than 1 : 3 in the races studied. In the golden Chinese race it is even as high as 1 : 4. In the crosses the female of the highest ratio transmits this character to its offspring.

Of the races studied the ratio between the average length of a worm and the average total length of a cocoon is always greater than 1 : 2 and reaches a maximum in the golden yellow Chinese race and is a minimum in the green Japanese and native yellow races.

A. — *Total length of thread* (Mean values).

	metres	
Yellow Perugia	807	Shantung
Yellow Biome	1059	Corea
Yellow Montana	920	White bivoltine
Corea	583	Hybrid bivoltine female \times
Yellow Persian	850	pollis male
Green Persian	860	Hybrid bivoltine female \times
Terni (1899)	767	male
Terni (1899)	750	Hybrid bivoltine female \times
Yellow Cyprus	930	male
Native yellow	1090	

B. — *Average length of reelable silk.*

	metres	
Pure native yellow	794	Hybrid native yellow female
White Japanese	593.5	white Japanese male
Green Japanese	515.5	Hybrid golden yellow Chinese
Golden Yellow Chinese	655.5	male \times native yellow male
Bivoltine Padua	749.5	Hybrid native yellow female \times
Hybrid white Japanese female \times na-		en yellow Chinese male
tive yellow male	739	

C. — *Physical properties of the reelable silk (two years' average).*

Race of Hybrid	Mean weight of 150 metres in Italian denari (0.05 gms.)	Mean diameter of thread in μ	Mean elasticity in m.	Mean tenacity in gms.	Index of elasticity in the same denari
Pure native yellow	2,004	35.00	153.73	7.98	3.11
White Japanese	2,801	34.20	168.00	8.50	3.00
Green Japanese	2,030	32.33	148.81	7.29	2.90
Golden yellow Chinese	2,810	34.10	175.20	8.75	3.00
Hybrid white Japanese $\frac{1}{2}$ \times native yellow $\frac{1}{2}$	2,873	34.49	149.78	8.75	3.12
Hybrid golden yellow Chinese $\frac{1}{2}$ \times white Japanese $\frac{1}{2}$	3,222	35.83	157.29	8.12	3.00
Hybrid golden yellow Chinese $\frac{1}{2}$ \times native yellow $\frac{1}{2}$	2,785	33.78	165.01	8.26	3.00
Hybrid native yellow $\frac{1}{2}$ \times golden yellow Chinese $\frac{1}{2}$	2,887	34.38	160.88	9.07	3.00
Padua bivoltine	2,420	30.75	180.58	7.60	2.90

(1) The index number expresses the relationship between weight and length and corresponds to the English "count number." The legal Italian standard of 150 metres expressed in Italian denari (0.05 gms.).

There is a correlation between the average weight of an adult silk-worm, the length of the silk gland, the absolute weight of the reelable silk gland and average length of the reelable silk. That is to say that cocoons with very long cocoons have also very heavy silk glands and a very long reelable silk, with consequently an average higher weight of reelable silk corresponding to one of the two glands of an adult worm.

Parentes showing these qualities transmit them to their first crosses to an equal extent, for the intensity with which the above qualities are transmitted in the hybrid differs appreciably according to the sex of the particular parent.

The physical properties of the reelable silk of normal cocoons of the *reelable* are given in table C.

Sericulture in Egypt. — YACOB, GEORGES in *Bulletin de l'Union des Agriculteurs de France*, Year 13, No. 112, pp. 78-85, Cairo, October 1915.

The lack of exact statistics renders very difficult even an approximate estimation of the former importance of sericulture in Egypt, but the existence everywhere of old mulberry plantations gives some idea of the former scope of this industry. It is known also that Syria imported from Egypt considerable quantities of reproductive cocoons known as "Masri" which the Egyptians seed very much appreciated. The great development of mulberry cultivation during recent decades has completely overshadowed silk-rearing and it is only the energetic initiative of particular individuals and the fortunate results of their experiments that have saved this industry and shown its possibility of again occupying an important position in Egyptian agriculture.

The breeding experiments made on a large scale by MASRAFF at Ghizeh are of special mention, especially for the undoubtedly superior quality of cocoons obtained. The whites gave 1 kg of silk per 3200 gms of cocoons and the yellows 1 kg of silk per 3254 gms of cocoons.

At Ghizeh the mulberry plantations are increased each year and a model breeding station is now in course of construction which will be capable of giving instruction for a 1000 native families.

The abundance of cheap labour is one of the factors most favourable to the success of this industry.

Another factor of great importance is the increased production of mulberry leaves that can be obtained in the fertile irrigated Egyptian delta. The yield reaches from 22½ cwt to 279 cwt per acre so that 1 *feddan* (1½ acre) of mulberry trees is sufficient to rear 8 to 10 ounces of eggs (produce from 880 to 1100 lbs of cocoons. The cost of breeding is estimated at about £2 per ounce, leaving a net profit of £32 to £40 per *feddan* based on a selling price of 1s. 1d. per lb of cocoons.

In spite of these favourable conditions, however, State intervention is almost indispensable to obtain a greater development of silk-worm rearing.

With State assistance the following advantages may be secured:

1. The assurance to the *fellah* of good conditions for the sale of the pro-

- 2) the free distribution of grafted mulberries to extend the plantations.
- 3) the free distribution during the first year of silkworm eggs.
- 4) the awarding of prizes to the best breeders.
- 5) the diffusion of theoretical and practical knowledge at :
 - a) of Agriculture, Ghizeh and at other practical schools.

Further advantages of this industry are :

- 1) the second crop of leaves could be used for fattening of sheep done in Syria ;
- 2) it would supply a better fuel for domestic purposes than the first crop and help to remedy the lack of fuel which compels the flocks to burn dry sheep dung for this purpose.

21; - **Experiments in Silkworm Rearing in Tripoli.** — *Bollettino di Istruzione Agricola Ministero delle Colonie*, Year III, No. 8-9, pp. 517-522, Rome, September 1915.

In May 1915, the Agricultural Bureau of Tripoli began experiments in silkworm rearing with a view to testing the possibility of obtaining good results in the region of the coastal oases in Tripoli. The mulberry trees growing in the gardens of the oasis are at present used chiefly as fruit trees and more rarely as fruit trees. The experiments were carried out under the following conditions : *a*) in a locality situated near a garden of the oasis ; *b*) cut out in the ground with one side open and covered with a reed mat ; *c*) reared in the above pit until the last moult then transferred to the locality mentioned in (*a*) ; *d*) reared in a subterranean locality, and well ventilated and situated in the buildings of the Sidi-Masri in the open steppes.

The constant winds cause considerable injury to silk-worms in the pits. The best results are obtained with silkworms removed from the pits before the last moult. The experiments under conditions *a* and *c* gave a normal course and gave good results, the former gave the highest and the latter the best cocoons.

The reed mats upon which the natives rear the worms do not appear very practical since they absorb too much moisture and soften easily. They require frequent changing and more open meshes to facilitate the circulation of the air. Several vegetable products were tried under the same conditions but all had more or less serious drawbacks. The question of the choice of materials remains for further study and the development of a reliable technique can only be attained by degrees. However, these experiments show that silk-worms can be reared in Tripoli with reasonable results.

The future activity of the Bureau of Agriculture will be directed along two lines : experimental researches on the best systems of rearing and the application of administrative measures towards encouraging the industry amongst agriculturists and natives. Samples of the cocoons were sent to Professor Verson at the Royal Sericultural Experiment Station at Turin, the results of which are summarised in special tables.

Examination of a Sample of White Oval Cocoons from Kiang-Sou, China. *Industrielle, Year 11, No. 26, pp. 700-702, Rome, December 21, 1915.*

The Silk Research Laboratory at Milan has examined a sample of cocoons of Kiang-Sou Cocoons of an elongated oval shape and of a yellow colour obtained last spring from a batch of industrial Chinese cocoons at the Royal Sericultural Observatory at Ivry.

After separating the really white cocoons (0.05 per cent) from the waste cocoons (0.01 per cent), the various shades of yellow (0.82 per cent) and the doubles (0.12 per cent) they were tested for the following characters: average cocoon size, ratio between cocoon and chrysalid, length and weight per unit length of reelable silk, industrial selection of cocoons, weight per unit length of silk thread, dynamometric tests, loss on washing and loss of gum.

The cocoons examined showed the most appreciated qualities and in particular one of the most regular with regard to the yield of silk, shape and weight of cocoons, etc.

As was formerly observed in previous studies of other important races of Chinese silk (Voozia, Shaoshing, Dong-Ding, Sagnew), the percentage ratio between the cocoon and chrysalid was fairly high, however, the reeling (little beating being required to obtain a good thread) and complete utilisation of the cocoon, reduces the proportion of waste to a minimum, with a considerable increase in the yield of raw silk.

The raw-silk of Kiang-Sou cocoons leaves nothing to be desired with regard to uniformity of colour, gloss, consistence, etc. The exceptionally regular reeling of the thread enables a raw silk to be obtained by selection under industrial conditions, of a remarkable regularity and evenness of colour. Examination on the black table shows that the number of faults (breaks) even in the most valuable silks (curling and matting together together) was very limited.

The weight per unit length ("titolo") of the raw silk was very regular, and in control reeling tests the variations did not exceed 3 deniers (about 0.05 gr.) on an average titolo of 1.57. As in the case of the best Chinese white cocoon races examined the proportion of sericine was low, not exceeding 10.4 per cent.

Canadian Musk Rat (*Fiber zibethicus*) Injurious to Fish in Austria.

Wiener Zeitung, J. in Österreichische Forst-und Jagd Zeitung, Year 34, No. 51, p. 315 Vienna, 1915, April 17, 1915.

Several methods of destroying the musk rat in fish-ponds in Austria have been tried but without practical results up to the present. Researches have been in progress with a view to their destruction by means of bacteria (1).

An apparatus for trapping this pest has recently been invented by Austrian Imperial Forester, and promising results have been obtained, 1000 of animals having been captured in a single summer.

¹ *F. J.* April 1915, No. 417, also *F. J.* Feb. 1915 No. 242.

The apparatus (which is minutely described and illustrated by the writer) is placed at the exits of water courses, in open ponds, etc., and once the animals enter they are unable to escape and may be easily killed. The size and shape of the apparatus varies according to the size of the pond which it is intended to be fitted and its price varies from \$50 to \$100.

FARM ENGINEERING.

AGRICULTURAL MACHINERY AND IMPLEMENTS

216 - **New Plans of U. S. Department of Agriculture Concerning Farm Machinery Implements.** FAWCETT, WALLON, in *Farm Implement News*, Vol. XXV, No. 1, pp. 16-17, Chicago, September 30, 1915.

With the object of inducing more and better farming, the U. S. Department of Agriculture in its programme for next year has included a large amount of work on farm equipment.

The Office of Farm Management will prosecute investigations on farm management and farm practice, it will spend about \$10,000 in the study of farm equipment and four experts will devote the whole of their time to this work, which is to "determine the character, cost and value of farm machinery on farms of different types and sizes in different parts of the country". The plan of action will be to collect at first hand all the available data dealing with the experience of farmers in regard to the various items of farm equipment and then draw conclusions from the study of the field reports.

Among the subjects to be investigated are: light tractors, the design and cost of the various types of farm fences, green house equipment, heating systems, the machinery and implements best suited to the swampy lands of Michigan, Wisconsin and Minnesota, the means and methods needed for farming the swamp lands of the north central States, the sandy belt States and the sandy lands. Especially important will be the investigations on incubators with the object of increasing their efficiency. A fund of \$1000 is set aside for the examination of the relative efficiency of the various types of spraying apparatus now on the market in order to determine the most economical types for given kinds of work.

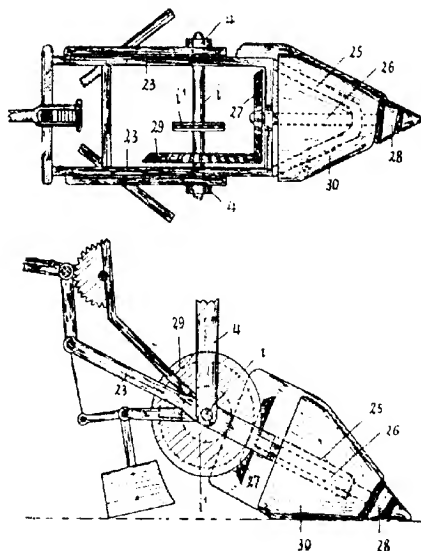
The Office of Grain Standardization will pursue investigations with a view to determining to what extent the commercial value of grain is affected by present methods and machinery used in harvesting and handling.

Another new investigation on the part of the Government has been assigned to bring within reach of farmers effective waterproof and fireproof fabrics for use as wagon covers, stack covers and the like. The examination into the causes of thresher explosions and fires is being extended, as last year more than one million dollars' worth of farm machinery were destroyed in the Pacific north west from this cause.

One organized division of the agricultural department is the Office of Agriculture and Rural Engineering. It will deal with the whole subject of agricultural machinery and include a continuation of traction tests, and it will take into account such factors as width of diameter of wheel, type of axle bearing, etc. The same Office will concern itself with the subjects of drainage on the farms, farm drainage, the construction of farm buildings, farm engines, the durability of the materials used in sprayers, pumps and for irrigation, while yet another office, that of Irrigation and Watering will prepare a report upon subirrigation and watering by means of canals.

Screw Furrow Opener.—*Maschinen Zeitung*, No. 24, pp. 65-6, Berlin, December 1907.

A furrow opener constructed by BRUNO HERN of Dohma, Saxony, patented in Germany under No. 288 885 is an attachment for potato



Screw Furrow Opener.

machines and the like. Its chief features are: a screw which bores into the ground and a conical case placed behind the screw which gives the furrow a definite breadth and stiffens its sides that otherwise might easily cave in. Fig. 1 shows the plan and fig. 2 the side view of the machine. Two

arms 4 are fixed to the usual frame of the planter, they bear a shaft 5, which a chain sprocket i_1 and a bevel gear 29 are mounted.

The shaft bears also a frame 23, the front of which is traversed by a shaft 26 carrying, at one end, a bevel gear 27 which gears perpendicularly at right angles with wheel 29; while the other extremity passes through a support 25 fixed to the front of the frame and ends in the screw 28 which bores into the soil. Behind the screw the sheet iron casing 30 which forms the furrow is situated.

When the machine is drawn forwards the borer is caused to revolve by a chain, not shown in the figure, on the sprocket i_1 which drives the shaft 5, and, by means of the bevel gears 27 and 29, the shaft 26. As the shaft 26 can rotate on the shaft 5 the inclination of the furrow opener can be varied as required.

218 - **Self-lighting Attachment for Smudge Pots.** — BYERS, CHARLES. *Scientific American*, Vol. CXIII, No. 21, p. 115. New York, November 2, 1906.

It is estimated that there are between 2 $\frac{1}{2}$ and 3 million smudge pots in use in the State of California alone and they are also used extensively in Florida and to some extent in Colorado and other States. They serve to protect orchards against frost as they can raise the temperature of an orchard by approximately 10 degrees.

A self-lighting attachment of smudge pots, operated by a thermostat, has recently been invented. When the temperature sinks to a certain point a fire is automatically started and the pot proceeds to perform its duty.

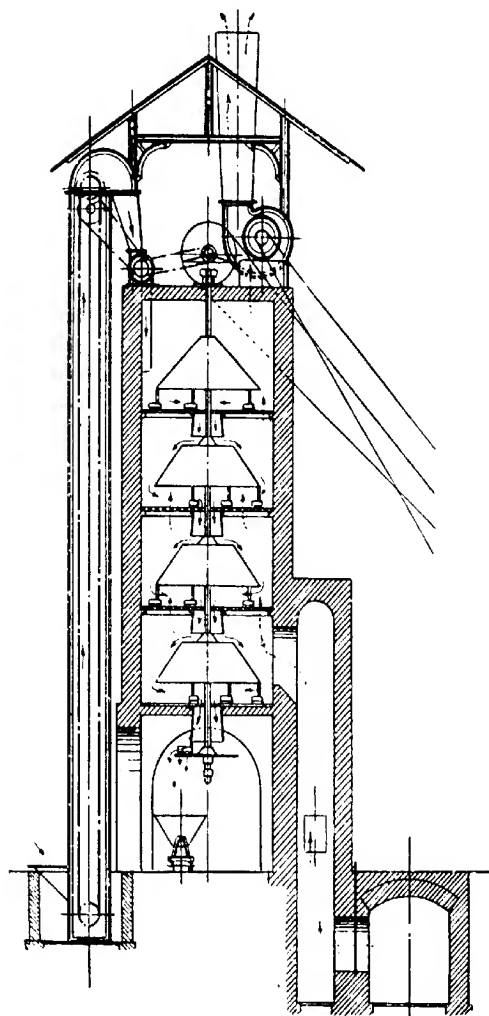
This thermostat when contracted by the cold to a certain predetermined degree of temperature releases a cup of acid, which spills into a compartment of the smudge pot where it comes in contact with a combustible material with another chemical and fire is thus produced which, in turn, heats the crude oil or petroleum in the pot. The thermostat may be regulated to operate to within half a degree of any temperature desired and the construction is such that the acid can be released only by the thermostat. The pots are constantly in readiness and require no attention until they have been fired when, of course, they must again be filled with oil. The self-lighting attachment resets.

219 - **Agricultural Desiccating Installations.** — MALPEAUX, L. (Director of Agriculture, Pas de Calais) in *La Vie Agricole* (Yverdon), No. 1, pp. 1-8. Paris, 1906.

Several agricultural industries leave by-products such as brewers' grains and the like which are useful as food for live stock but for their low keeping qualities, high water content, and for the fact that they are produced in large quantities during short periods, must be conserved and within a short distance of the place where they are produced.

In order to remedy these difficulties and to avoid the losses due to ensilage, which are sometimes as high as 30 per cent, desiccation is

(1) See also *E*, Jan. 1910, No. 8.



HUILLARD'S desiccator.

resorted to. At first it was limited to beetroot pulps but it has since extended to beetroots, potatoes, and brewers' grains. Especially in this desiccation is much practised. Out of 360 sugar mills no less than 225, their pulps, whereas in France only 3 do so.

Desiccation of beets. — Of late years several desiccators on the French system have been installed in France, but while they produce good wares their cost of production is too high. The desiccation of sugar beets costs not less than 9s 8d per ton and at the price of 20s 6d per ton for sugar beets and 14s 6d per ton for semi-sugar beets, the price of dried slices are 6s 6 $\frac{3}{4}$ d and 6s 5 $\frac{3}{4}$ d per cwt. respectively.

The French desiccator of M. HUBILARD (1) with cone-shaped gratings, fig. 1, has attained a high degree of perfection. One of them installed at Coudekerque-Branché (Nord) at a cost of £ 7 000 treats about 100 tons of beets containing 82 per cent of water in 24 hours and produces 100 tons of dried slices containing 10 per cent of moisture at a cost, with coal, of 18 7 $\frac{1}{4}$ d per cwt.

The food value of these dried slices approaches that of grains, but they contain however less protein and more carbohydrates, for the most part in the form of sugar, and they can be fed advantageously to horses and cows, but are not recommended for fattening stock as they cost more and contain less protein.

The tops and tails of the beets can also be passed through the desiccator and increase the profits of the sugar mills.

Desiccation of beet leaves and tops. — In Germany for some years several installations for the drying of beet leaves and tops have worked, the most part with BÜTTNER'S process, by means of an apparatus consisting of three gratings placed one on top of the other with an automatic loader. For 1 cwt. of dried product 4 or 5 cwt. of fresh leaves are required, and the drying is from 9 $\frac{1}{4}$ d to 9 $\frac{1}{2}$ d per cwt. while its food value is about 100 cwt. but it is sold dearer.

The leaves and tops produced by an acre of beets are about 600 cwt. per acre which yield about 1 $\frac{1}{2}$ tons of dried produce.

Desiccation of potatoes. — Potatoes cannot be dried whole because they become horny in the process. They must be sliced.

There are in Germany about 250 potato drying plants which produce yearly 7 to 800 000 tons of potatoes. The cost of desiccating varies from 28 10 $\frac{1}{4}$ d to 4s 6d per ton in the large works and 7s 3d to 8s in the smaller ones. According to KELLNER'S experiments, made in several parts of Germany, one third of the ration of oats for horses can be very advantageously replaced by an equal weight of dried potato slices, which have almost the same food value as oats. For pigs the dried potatoes are also very successful in the fattening of pigs.

Desiccation of Jerusalem artichokes. — Among the crops which are desiccated, the Jerusalem artichoke is to be mentioned. It is not so well known as highly as it deserves to be, on account of the difficulty of keeping it any length of time after being lifted. By desiccation this difficulty is

(1) See also B. Aug. 1913, No. 974.

water, and the dried slices keep well especially if compressed under pressure cake.

Green artichokes can be dried in HUILLARD's apparatus. Their cost, which is about 80 per cent, is reduced to 15. The cost of drying about 1s 5d per cwt. of dried product, the total cost of which, green artichokes at 11s 3d per cwt. is 3s 6d per cwt. while its food value is at least 5s 3d to 5s 7d per cwt.

Preparation of other by-products. -- Pulps, brewer's grains and pomaces can be easily transported, stored and used. In order to realize greatest economy they must of course be desiccated in the works where they are produced and, as far as possible, by means of the waste heat.

Among the French desiccators the writer mentions DONARD's vacuum desiccator especially for the by-products of the distilleries of amylaceous grains and HUILLARD's desiccator, which is simple and strong, it works with regularity, dries evenly and has been used in a number of different instances.

It consists essentially (see fig.) of a round masonry tower divided into four stories by perforated cast iron floors. The stuff to be dried is introduced automatically and continuously on to each of these floors in successive layers of uniform depth. The gases are drawn in hot and dry at the top of the tower, by a special ventilator which forces them through the floors and finally expels them, quite cool and laden with moisture, outwards.

The machinery consists chiefly of a central vertical shaft suspended on bearings carrying three or four truncated cones, to each of which shovels are attached. The object of these is to move the stuff towards the centre of floor whence it falls through an aperture and a kind of funnel on truncated cone below. The mass of stuff between the funnel and the shovelling cone obliges the hot air to pass through the perforated floors thus using the heat most efficiently. The heating can be effected either by a coal heater or more economically by using the waste heat from other works.

Besides the desiccator above described M. HUILLARD has devised small ones on the same principle for farms and industries on a small scale. The minimum "desiccator" is only 5 ft 10 in. in height and 36 inches in diameter.

Review of Patents.

Plough machines and implements.

164 078.	Ditching machine.
164 306. — 164 366.	Ploughs.
164 260.	Farm implement.
164 612.	Ditching machine.
20 764.	Furrow cleaner.
20 789.	Cultivator.
39 670.	Harrow tine.
39 100.	Rotary tilling machine.

- 39 191. Device for motor ploughs.
 39 223. Plough beam.
- United Kingdom 17 278. Motor driven cultivating machine.
- United States 1 153 676. Tractor for ploughs.
 1 155 536. Combined cultivator and weed cutter.
 1 155 537. 1 155 536 + 1 160 025. Ploughs.
 1 159 061. Mouldboard for ploughs.
 1 159 115. Furrow opener attachment.
 1 159 297. Automatic disengaging motor plough.
 1 159 368. Weed cutting cultivator.
 1 159 479. Wheeled plough.
 1 159 463. Motor propelled tillage machinery.
 1 160 027. Cultivator shovel.

Fertilizer distributors

- Sweden 39 146. Fertilizer spreading machine.
 39 192. Adjustable feed for fertilizer spreading machine.
- United Kingdom 17 266. Sprayers or spreaders for thick, muddy or manure.
- United States 1 138 100. Fertilizer distributor.

Drills and sowing machines

- Sweden 39 069. Drill.
 39 192. Device for sowing machines.
 39 226. Device for potato planters.
- United Kingdom 17 757. Potato and like planters.
- United States 1 158 811. Corn planter.
 1 159 443. Corn planter driving mechanism.

Reapers, mowers and other harvesting machines

- Denmark 20 077. Cutter bar for mowers.
 20 084. Device for collecting grain in harvesters.
 20 772. Device for reapers.
- Switzerland 71 423. Sheaf binder.
- Sweden 39 006. Horse rake.
 39 150. Fastening for scythe handles.
 39 194. Hay rake and carrier.
 39 224. Gin for hay elevators and the like.
 39 700. Fastening for tines of horse rakes.
- United Kingdom 17 159. Lawn mowers.
- United States 1 158 418. Harvester.
 1 158 470. 1 159 370 + 1 159 547. Corn harvesters.
 1 158 500. Cutting apparatus for mowing and reaping machine.
 1 158 530. Hay loader.
 1 159 444. Hay rake and tedder.
 1 159 571. Grain shocking machine.
 1 159 887 + 1 159 888. Grain harvesters.
 1 159 987. Tractor binder hitch.
 1 159 988. Tandem draught connection for harvesters.

Machines for lifting root crops.

- 20 654. Root lifting machine.
- 20 727. Machine for lifting and topping root crops.
- 20 734. Apparatus for cleaning and carrying root crops.
- 20 750. Potato digger.
- 1 158 956. Beet harvester.
- 1 159 110. Wheeled potato digger.

Threshing and winnowing machines.

- 149 568. Self feeder for threshing machines.
- 1 158 944. Threshing machine.
- 1 160 688. Feeding mechanisms for corn huskers.

and implements for the preparation and storage of grain, fodder, etc.

- 164 975. Silo.
- 20 685. Straw press.
- 141 220. Automatic needle for hay and straw presses and the like.
- 39 007. Shovel for riddling potatoes.
- 1 159 388. Overhead hay carrier.
- 1 159 935. Feed cutter.
- 1 159 945. Hay press.

Dairying machines and implements.

- 39 068. Hygienic milk-can.
- 39 301. Device for pulsating milking machine.
- 1 159 738 - 17 739 - 17 740. Cow milkers.

Other agricultural machines and implements.

- 164 508. Animal trap.
- 159 128. System of ventilation especially applicable to esicators for macaroni.
- 71 289. Watering installation with troughs filling automatically.
- 71 425. System of silkworm nursery for warm countries with the object of keeping a suitable temperature for silkworms.
- 39 148. Machine for making covered drains.
- 39 267. Tree felling and sawing machine.
- 1 159 265. Appliance for extracting nicotine from tobacco by reduced pressure.
- 17 363. Machine for prepping fibres for spinning.
- 17 488. Incubators.
- 18 059. Machine for depericarping fruit.
- 18 134. Ring for pigs.
- 18 231. Packing device for eggs.
- 1 159 163. Tractor chain (knollless track).
- 1 159 223. Tractor.

RURAL ECONOMICS.

111 **Influence of the Size of the Farm upon the Wages of Labour in the Irrigated Sections of the United States** SPILLMAN, W. J. Farm Management Section, Education Projects, in the *Country Gentleman*, Vol. LXXX, No. 49, pp. 1532-3. December 4, 1918.

The Federal Office of Farm Management has made surveys of the farming business (1) in many of the irrigated sections of the United States, particularly in Utah and Arizona. In several farms, grouped according to the wage made by the owners of the farms and their families were studied. It was found that in thirty-five small farms where the farming was as intensive as market conditions permitted, with an average crop area of 22 acres, the average wage made by the owners was \$247, just a little more than half of local farm wages.

Two types of farming in Utah were quite successful when the size of the farm was sufficient:

1. — Farms of about 40 acres in which 5 to 7 acres were devoted to sugar beets. The yield of this crop was, in these farms, much above the average for the country, while the price was approximately the same. The best economical results were obtained when the sugar beet business was conducted mainly by the members of the family, and when it was combined with dairying or poultry keeping or both. Farms smaller than this were generally not successful.

2. — Farms of 80 acres or more under general farming, including production of grain and livestock.

The conclusion drawn was that with sugar beets the forty-acre farm in that region was feasible, without the sugar beets eighty acres should be the minimum size of the farm. With lands at a reasonable price this should be successful on the basis of dairying, beef cattle, grains and the sized patches of sugar beets.

During the last two years Prof. R. W. Clothier of the Farm Management Office has made a detailed analysis of the business of 543 farms under irrigation projects in Arizona. Forty of these farms were less than 15 acres in area, averaging about 10 acres. The average wage made by the owners was \$235.

The 20-acre group contained 63 farms; the average wage made by the owners was \$265. The 30-acre group contained 43 farms; the owners made wages averaging \$250.

Thus 140 of these 543 farms were so small that their owners made wages just about half those that a good farm labourer can command in that region. These farms are too small for satisfactory results. The land is also too high priced, the average for these groups of farms being \$18500 an acre.

The 40-acre group of farms contained 86 farms, whose owners made

(1) See No. 216 above.

4. The 60-acre group made wages of \$458. It is only in the group which contains 97 farms that the owners make wages equal to a good farm labourer: \$580.

On the other hand there were 44 farms in the survey averaging 375 acres. These made enough to pay 8 per cent on their investments and have an average salary of \$2288. A few of the small farms did very well but not the fruit and vegetable farms, but mainly poultry and dairy concerns. Poultry was more prominent on the small farms and dairy cows on the larger ones.

These agreements in the case of the Utah and Arizona surveys with the realities in all parts of the Eastern half of the United States justifies the opinion that farms of less than 40 acres are not advisable on any of the subjects and that in irrigation enterprises 80 acres should be made the minimum size of farm.

Nothing is to be as productive as other lines of business; the writer thinks that 500 acres is not too large a limit to set upon the area which an individual is permitted to own under an irrigation project.

Regulation of the Association of Spanish Agriculturists for the Purchase, Sale and Leasing of Farms.—*Boletín de la Asociación de Agricultores de España*, No. 78, 1915, Madrid, November 1915.

Considering the difficulties attendant upon the investment of capital in agriculture, and considering also the want of an institution capable of supplying economic and analytical data on farms in the market, the Association of Spanish Agriculturists has founded a business office (Centro de contratación) for the use of its members and subject to the following regulations:

Special regulations for the purchase, sale and leasing of farms.

ART. I.—The Association of Spanish Agriculturists institutes a special office for the purchase, sale and leasing of farms, for the exclusive benefit of its members of the said Association and of the associations which belong to it as collective members.

ART. II.—The Association will present a detailed list of the farms to be offered, accompanied by photographs and other documents which may be necessary. It guarantees the trustworthiness of the data which it offers, under the responsibility of the technical Professor of Agriculture.

ART. III.—The Association will keep two registers: One containing the farms for sale or lease, the other the requirements of intending purchasers. In order to be inscribed in the first register, the applicant must apply to the Association or to one of the Associations belonging collectively to the Association; he must pay the fixed subscription of 100 pesetas annually to cover travelling and other expenses of the technical Professor on his visit to the farm on sale, its identification, the photographs, the data supplied etc. The applicant must also present a request for police control, together with an engagement to facilitate it.

The inscription in the requirements register takes place at the expense of a member.

Art. IV. — The technical Professor of the Association guarantees by his signature, the accuracy of the data supplied as to the quality of the class of crops, the means of communication, the buildings, etc., but not the acreage except when there exist plans proving the extent of the farm. The valuation of the farms is left exclusively to the appraisers.

Art. V. — When the sale or lease has been effected, the services of the appraisers have no fee of any kind to pay, as the services of the Association are gratuitous.

Art. VI. — Both offers and demands will be published in the Bulletin of the Association for the information of all its members.

Art. VII. — Any doubt or unforeseen difficulty which might arise in the application of this Regulation will be settled by the board of directors of the Association.

223 — **Labour Cost of Producing Maize in Ohio.** — GODDARD, L. H. and J. C. in *Bulletin of the Ohio Agricultural Experiment Station*, No. 266, pp. 8-10, Columbus, Ohio, December 1915.

The cost of labour in producing maize in Ohio is the largest item in the total cost.

The data given in this report were obtained from farms situated in various parts of the State comprising 200 fields with a total area of more than 2000 acres.

The total labour required averages 48.18 man hours and 38 man hours; and at 16 cents (\$d.) per man hour and 8 cents (4d.) per horse hour the total cost per acre is \$12.14 (£2-9-0), varying from \$9.62 in the Southwest to \$12.46 in the Northwest, \$10.28 in the Northeast and \$11.75 in the Southeast. The cost of labour in 34 municipalities averages 11 cents (9½d) for common labourer and 41 cents (1/10) for labourers with tools.

In many cases the crop yield per acre is not sufficient to pay for a single item of labour required to produce it, unless the labour is paid at an extremely low rate. Within certain limits the labour cost per acre is less on large fields than on small ones.

The cost of replanting, which is still a common custom, is more than that of the first planting by machine. It would seem that a considerable amount of the hand labour especially in cultivating could be replaced by machine work. The cost of harvesting is more than one third of the total labour cost, so that a great saving is effected by grazing the crop.

224 — **Economics of Apple Orchardling in the Pacific Northwest.** — LEWIS, C. and VICKERS H. A. in *Oregon Agricultural College Experiment Station, Bulletin No. 10*, Corvallis, Oregon, June 1915.

For the past four years the Division of Horticulture of the Oregon Agricultural College Experiment Station has been conducting investigations dealing with the cost of fruit production in the Pacific Northwest. These have entailed the study of a thousand orchards situated in the States of Oregon, Washington, Idaho and the Province of British Columbia.

TABLE II. — *The cost of Production of Apples.*

Orchard 6 to 9 years	Yield per acre, bushels	Per Acreage				Per Box	
		Main-tenance	Over-head	Handling	Total average	Main-tenance	Over-head
		\$ per acre	\$ per acre	\$ per acre	\$ per acre	\$ per box	\$ per box
Class I under 11 acres	150 40.85	74.18	71.09	186.12	0.2723	0.4941	0.4770
• II: 12 to 25 acres	158 35.93	71.56	64.97	172.40	0.2211	0.4525	0.4312
• III: 26 to 50 "	95 26.09	43.13	38.85	109.18	0.2832	0.4572	0.4340
• IV: over 50 "	77 19.16	39.01	37.82	95.69	0.2488	0.5066	0.4911
Total, orchard 6 to 9 years average	120 30.71	57.93	53.18	140.92	0.2564	0.4776	0.4621
Orchards 10 to 15 years							
Class I	225 52.93	100.69	95.34	257.66	0.2312	0.4875	0.4700
Class II	270 38.46	137.33	56.32	235.11	0.1344	0.4892	0.4680
Class III	188 31.77	85.29	52.31	169.34	0.1689	0.4535	0.4310
Total orchards 10 to 15 "	233 40.75	110.76	68.99	229.56	0.1782	0.4781	0.4570
Total orchards 6 to 15 years average	176.5 35.73	83.09	64.09	189.72	0.2173	0.4757	0.4595

of the orchard; treatment of the trees; intercropping with vegetables, fruit etc.; pasturing pigs, dairying (experiments drawn from practice) and poultry keeping in connection with orchards; tillage, pruning, fertilizing, spraying etc.; marketing of produce; estimate of a Bureau of Statistics and of a fruit grower's Protective League; utilization of low grade apples.

The second part of the Bulletin contains some complete and full reports furnished by orchardists on the cost of production and on the economic results of a certain number of orchards under various soil and topographic conditions.

225. — **The Problem of the Sale of Agricultural Products in the United States Connection with Economy in Farming.** — CARRIER, T. N. in *Proceedings National Congress of the United States, Forty-Fourth Annual Session*, Dallas, Texas, 1914, pp. 71-81, Kendall, W. Va., June 30, 1915.

In a communication made to the 34th National Congress of the United States, the writer first drew attention to the fact that the problem of increasing the supply of agricultural products in the country dependent upon the inducement in the way of profit that the farmer found for enlarging his enterprise, and that with the intensification, cost of cultivation, this profit can only be obtained by increasing the yield of the products, or decreasing the cost of the methods of production etc. The writer then explained the economic problem of the sale of agricultural products and the purchase of the raw materials necessary to cultivate

Under the conditions at present obtaining in the United States, the great problem to produce for farmers one of the best means of increasing or decreasing respectively the price of the products sold and the cost of those produced.

The writer remarks in this connection that, the productive capacity of American agriculture is always inclining in its attempts to determine what sized farm has the greatest productive power, is the small farm which will occupy the full working time of an average farm family equipped with the best tools and team force. In horticulture this will be a farm of 10 acres; in general hay and grain farming, a farm of about 40 acres; in pasturage it will take a larger number of acres. In the grain belt of the stock region 40 and 80 acres farms, and the big bonanza farms are going to disappear, while the concentration of such farming is taking place on farms of from 160 to 200 acres. The small farm possesses, from a standpoint, the greatest productive capacity, as the farmers family is the working unit, and this obliges the owners of larger farms to be content on the other hand this type of farm is rather inefficient in its productive power; here is where cooperation comes in, a large number of inefficient, producing units unite to form a larger and more efficient working unit.

This fact exercises considerable influence upon all farming economy, the different degree of difficulty presented by the sale of various rural products in proportion to the area that can be used for their production in the above-mentioned small farms, leads to important consequences: the abandonment of all agricultural specialities, the sale of products requires more efficient bargaining capacity and a more complete central organisation; and the cultivation of staple crops that are less difficult to sell.

This tendency towards the cultivation of staple crops on the small farm is in direct contradiction to what ought logically to be practised, viz. the raising of special crops which can make better use of its more intense productive capacity. One symptom of this tendency which is due to the influence of other more important economic factors, is the gradual migration of the wheat belt towards the virgin soil. The centre of winter wheat production is now in Kansas and the centre of spring wheat production in Montana, but this migration will probably continue until most of the wheat is produced beyond the Canadian border. The same tendency shows itself in the westward migration of the cattle producing area, and shows the necessity for small farmers of: 1) growing higher-priced crops which will be the more difficult to sell the smaller the quantity offered to the market; 2) cooperating, so as to oppose the capitalist farmer by the aid of a commercial organisation which they did not individually possess.

The phenomenon of monoculture in the cotton zone is, according to the writer, caused by the difficulties which the farmer has hitherto encountered in the sale of the other crops he could produce. This uncertainty in the conversion to new crops will doubtless continue until the farmer has

recourse to cooperative organisations which will supply him with the means of conquering the markets.

The writer then deals with the importance of an organisation for the purpose of obtaining the principal means of production: capital. The importance is continually increasing, seeing that American agriculture is based on economy of labour; he further remarks that if the problem is not solved, especially as regards those farmers not yet possessing the means necessary for agricultural undertakings in America, farming in the future will be beyond the means of any but capitalists.

In conclusion, Dr Carver speaks of the disastrous effect of the lack of a cultural organisation in all its forms, as the means of preventing the various forms of social economy from depriving rural communities (as they would logically do), of all that serves to beautify and render dignified the life of the tiller of the soil.

226 — **A Critical Study of the Methods of Valuation.** — CHERIC, RENO, 1915. — *Società degli Ingegneri e degli Architetti Italiani*, Year XXX, Part 17, 1915, pp. 305-310; Part 20, pp. 329-331; Part 21, pp. 342-345; Part 22, pp. 357-360. — Rome, August-December 1915.

The criticism made by Prof. Aereboe (1) of the two analytical methods of valuing land, the one based on the returns, and the other upon the capital value, and his proposal that recourse should be had to the synthetic system, have given an opportunity for renewed discussions between the partisans of the synthetic-comparative (so-called "empirical") system and the upholders of analytic (or "rational") valuation.

In his article, the writer has undertaken to show the reasons for giving to the analytic method the first place among the schemes of valuation, as being the one which, especially during periods of disturbance in the land market, is capable of rendering signal service.

After having pointed out the deficiencies of Aereboe's empirical-statistical method from the theoretical stand-point, the writer examines the practical application of this system in Italy. He bases his remarks on the organisation devised by the partisans of this method which is as follows:

- a) An exact classification of the land in each of the given districts to be valued.
- b) The systematic registration of the sale and purchase prices, bringing into consideration the class to which the land which is the object of the contract belongs.
- c) The systematic elaboration of the collected data and the determination of the average unit prices of each class.
- d) A determination of the coefficients to be applied to the average unit prices, in order to make allowance for such factors as the situation of the land, means of communication etc.

The writer draws the following conclusions:

(1) Cf. *Proposals for Reform of the Valuation System Based on the Returns of the Soil*. — *R.*, March 1914, No. 278.

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1. The empirico-statistical method of valuation is quite impracticable owing to the special conditions of landed property in that country, and to the fact that such a system would necessitate the creation of valuations which it would not be to the interest of any enterpriser to establish.

2. Apart from this great objection, and supposing that the necessary data could be established in a suitable manner, the final result of the empirico-statistical method, namely the estimation of the value, would be marred by such errors of valuation as occur in the use of other methods, in view of the fact that the personal judgment of the appraiser enters for an important part in this method, both in the elaboration of the data and in the comparative estimation.

3. The empirico-statistical method, which only gives one factor, is not adapted, like the analytic system, to the objects in view in the valuation of landed property, and still less to such matters as the valuation of loans on real property.

4. The method of analytical valuation at present largely adopted in India is therefore not to be condemned, nor even regarded as organically defective, simply because its application presents practical difficulties which give rise to the possibility of error to the inexperienced.

AGRICULTURAL INDUSTRIES.

Factor the Indian Rice Beer Ferment. By JOHNSON, C. M. and RAM AYYAR, C. S.,
Department of Agriculture, India, Bureau of Fermentation, Vol. I, No. 6,
Plates, Calcutta, October 1911.

1. "Factor" (known also as *macha*, *ram* or *utid* according to the various regions of India) is the ferment or culture artificially prepared for the manufacture of Hindu rice beer (*bacha*) and of the rice spirit distilled therefrom. It contains micro-organisms capable of converting rice starch and rice into alcohol and carbonic acid gas by the action of the native yeasts. Researches have been carried out on its preparation, its composition and action with a view to the Government control of its manufacture and sale.

2. The researches were directly concerned with the determination of :
(1) The species of micro-organisms present in the various samples of Factor; (2) the physiological activity of these micro-organisms in relation to their fermenting power and alcohol production; (3) the function of the various substances added to the ferment, e. g. roots, stems or leaves of certain plants; (4) the reciprocal relationship between beneficial and detrimental micro-organisms found in the *bákhar* or easily introduced during its use; (5) the possibility of acquiring a sufficient knowledge of the fermentation process so as to be able to instruct the manufacturers in better and more scientific methods of making this ferment.

3. The method practised by the natives consists in making a thick paste of the ground rice with water to which is added small quantities of the roots, leaves or stems of certain plants and condiments. This

paste is made into small cakes or balls which are then dusted over with powder of old cakes. They are kept in a dark place for 3 or 4 days, during which they are dried in the sun and stored in a dry place until ready for use. This method of preparation is varied in different regions by the addition of various plants or condiments, sometimes smoke dried and mixed before mixing with the rice paste. In making the beer the *bākhar* is added to the half cooked rice at the rate of 1 part per 10 parts of the mixture is then put into baskets for 24 hours, during which the steam penetrates the mass and begins the saccharification of the starch. The baskets are then placed in earthenware vessels with water and fermented for 24 hours. The liquid is then filtered and may be used as pachwai (rice beer) or for the distillation of alcohol.

Several samples of *bākhar* from various sources have been subjected to biological analysis, making cultures on ammonium nitrate agar. The composition was found to be as follows :

1. Durgajding	<i>Rhizopus (Candelabra) (Chrasseri) Var.</i> <i>Domatium</i> <i>Pennicillium</i> 1 species of yeast
2. Ranchi	<i>Major Pratin</i> { numerous colonies, <i>Domatium</i> . . . { <i>Aspergillus niger</i>
3. Purnia	<i>Rhizopus</i> { <i>Domatium</i> { weak growth Yeast . . . }
4. Chahosa	<i>Major Pratin</i> <i>Domatium</i> 2 species of yeast
5. Balasore	<i>Major Pratin</i> - abundant <i>Domatium</i> 2 species of yeast - numerous colonies
6. Rajmahal	<i>Major Pratin</i> - abundant <i>Rhizopus</i> - not numerous, No yeasts.
7. Dumka	<i>Major Pratin</i> - abundant <i>Domatium</i> <i>Rhizopus</i> Yeast
8. Sambalpur	<i>Major Pratin</i> <i>Domatium</i> Yeast

Cultures of the same kinds of *bākhar* were also made on ordinary agar and in addition to mucorineae, species of bacteria in limited numbers were obtained from the samples from Ranchi, Balasore and Rajmahal. Some of these samples also showed the presence of *Aspergillus niger* which is injurious to saccharifying species.

To determine the saccharifying power of the various kinds of *bākhar* 1 gr. of each sample was inoculated into 100 gr. lots of steamed rice

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at $30^{\circ}\text{C}.$ for 4 days after which the sugar content was determined by solution. The results were as follows:

1. <i>Aspergillus Oryzae</i>	80.6	8. Raimahal	4.9
2. <i>Aspergillus Niger</i>	76.4	9. Darjeeling	25.4
3. <i>Aspergillus Glaucus</i>	58.5	7. Dumka	12.4
4. <i>Aspergillus Flavus</i>	41.2	8. Kosi (Japan)	128.4

The “*koji*” ferment from Japanese rice beer has a much stronger saccharifying power than the samples of Indian *bikhar*. The former is a practically pure culture of *Aspergillus Oryzae* (Mihburg) Cohn. on rice grains.

Cultures of a certain number of the fungi were sown in 1 per cent agar slantings and incubated at $30^{\circ}\text{C}.$ The number of days required for complete disappearance of the starch was as follows:

<i>Aspergillus Oryzae</i>	after 8 days	<i>Mucor saccharus</i>	after 27 days
<i>Aspergillus Niger</i>	17		
<i>Aspergillus Glaucus</i>	17	<i>Mucor Pratinus</i>	starch present
<i>Aspergillus Flavus</i>	20	<i>Monilia</i>	after 30 days,

In a saccharification experiment with the same species and with polished rice grains showed the superiority of *Aspergillus Oryzae*. It also showed that the intensity of growth and hence of saccharifying power of the various species of fungi in rice depends largely on the conditions of temperature, humidity and aeration. It is therefore of great importance to know the optimum conditions for each species and to maintain them during the process of saccharification.

To determine the fermentative power of Indian *bikhar*, lots of 100 grs. of polished rice were inoculated with samples of 1.5 gr. of *bikhar* from four different sources. The mixtures were incubated at $30^{\circ}\text{C}.$ in cottonwool stoppered bottles for 24 hours after which 250 cc. of water was added to the bottle and the cultures incubated for a further period of 5 days at $30^{\circ}\text{C}.$ A further addition of 150 cc. of water was made and the whole contents then distilled. The results were as follows:

Source of <i>bikhar</i>	Quantity of liquid distilled	Specific Gravity at $20^{\circ}\text{C}.$	Quantity of pure alcohol
1.	104 cc	0.961	61.6 cc
2.	100 "	0.965	53.5 "
3.	80 "	0.959	49.5 "
4.	95 "	0.986	49.3 "

After cultural and fermentation experiments were carried out to determine the part played by the vegetable matter added to the *bikhar* by farmers.

The results of these experiments lead to the following conclusions:

- 1) These materials are of no value as inocula.
- 2) After the addition of these materials the colonies of yeasts in the *bákhar* become more numerous and more vigorous so that the time the starch is transformed into sugar, the yeasts are easily predominate over the harmful bacteria present in the rice.
- 3) These materials are also directly injurious to the development of bacteria in the *bákhar*, but the function of these materials both as to the yeasts and as an antiseptic is confined to the *bákhar* and does not extend to the fermentation of the liquid, the quantities added being small to be effective in the wet rice or in the rice beer.
- 4) These materials appear to have no direct effect on the colour or flavour of the beer.

A further experiment shows the fermentative action of various types of *bákhar* prepared in the laboratory, made up of combinations of cultures of the fungi with a strain of yeast. The best results were obtained with a mixture of *Ispergillus Oryzae* and *Saccharomyces cerevisiae* isolated from *bákhar* from Khasi.

The principle conclusion of these investigations is that the nature of *pachai* is not so much due to the absence of efficient amylolytic bacteria as to that of good types of saccharomycetes.

For this reason the brewer is recommended to make use of the wash from his own vats to inoculate the rice previously saccharified. If the *bákhar* ferments or failing this to obtain a separate supply from a reliable source.

228 - **The Sugar Industry of the Philippines Islands.** JONES, C. W. (Sugar Specialist, Bureau of Agriculture, Manila; in *The Louisiana Planter and Sugar*, Vol. LV, No. 11, pp. 300-302. New Orleans, November 6, 1913.)

The production of sugar in the Philippines for the year 1913 amounted to 370,000 long tons most of which was made into the molasses, muscovado sugar and sold as "bayon" or "mat" sugar, "pilon" and "panocha" sugar.

"Bayon" or "mat" sugar is packed in "bayones" or paper bags, hence its name. The juice is simply clarified by the addition of a small quantity of lime and concentrated in a battery of iron kettles. On cooling a pulverised yellow or dark product is secured.

"Pilon" sugar takes its designation from the name of the local earthenware jar in which it is made. Each jar has a capacity of about 180 lbs. of crude sugar and is provided with a hole about 2 inches in diameter at the bottom, through which the molasses drain away. The refining begins before the sugar is removed from the earthen jars. A layer of cloth is applied to the top and kept saturated with water which assists in washing away the molasses adhering to the crystals. The jars are then tilted and the white upper portion of the lump is dissolved, clarified with milk of lime, white of egg and finally re-crystallised during constant stirring. The crystals are often fairly white in colour and polarise over 99 per cent.

"Panocha" sugar is made by moulding the heavy masses of

the water leaks when it has nearly cooled. Coconut shells are often used for the clarification and evaporation is identical with the processes used for the "pilon" and "bayon" sugars. It is largely used by the home consumption, and during 1914 more than 24 000 tons of sugar were consumed locally.

A sugar refinery has been established using the local sugars, and it turns out 25 tons of finished sugar per day. There are also several class centrifugal factories for producing test sugar.

Rice is grown throughout the islands but there still remain vast areas in many of which produce only a single crop of rice each year or

19. **Fibre Industry of Mauritius.**—SICKKIDALL, F. A. in *Department of Agricultural Statistics, Bulletin* No. 5, pp. 1-18, Mauritius 1918.

The fibre industry is, after sugar, the most important agricultural industry of the colony of Mauritius. The "Creole aloe" (*Furcraea gigantea* var. *gigantea*) and the "Malgache aloe" (*Furcraea gigantea*) are the two most important fibre plants; it is estimated that they cover about 20 000 arpents (1 arpent = 1.043 acre). There are also some 1 500 arpents that have been planted in the Creole variety. *Azore rigida* var. *sisalana* (sisal) was introduced during 1905-1910; it is estimated that there are 60 75 arpents planted with sisal in the colony. These plantations require greater care, and longer stages, than do plantations of "Creole aloes".

The cutting of leaves is usually carried out by task work. The cutters are paid on the average at the rate of 11 1/2 d. per 100 packets, and it is generally found that one packet of leaves contains from 12-15 leaves and produces from 0.125 kilo of green fibre, and 0.175 kilo of dry fibre. The aloes are usually cut every 10-15 days, the number of leaves taken off at each cutting varies greatly with the weather and with the age of the plants.

From figures collected at various factories, it appears that an average of 100 leaves of Creole aloes will produce one ton of dry fibre. This gives an average fibre recovery of nearly 2.5 per cent. on the weight of leaves. Wet fibre gives an average yield of from 16 to 18 per cent. In 1914 there were 42 factories in operation, of which 25 were situated in the Black River district. Their average output is 55 tons of dry fibre with a minimum of 50 and a maximum of 100 tons.

"Grattes" (fibre scraping machines) are manufactured in the machine works of the Colony and cost from £14 to £18 each. They are capable of producing 1 ton of dry fibre per gratte, per diem, and are fed by hand. They are used in series, being driven by steam or suction gas engines. At the end of 1914 there were 11 suction gas engines with a brake horse power ranging from 18 to 40.

The Government of the Island of Mauritius has taken in hand the matter of the machinery for fibre production and is installing in the Black River district a new Corona Automatic Decorticating Machine with a view to ascertaining whether reduction in the costs of production cannot be effected.

In the annual report of the President of the Chamber of Agriculture for 1914 it is stated that the cost of production per ton of dry fibre approx-

imated £11.15.0 where water is employed, and £14 where steam is employed. The Royal Commissioners in 1909 obtained figures varying from £6.10.0 to £11.15.0 per ton. The costs of production were carefully enquired into during 1912. The transport of the leaves is naturally a very important item. In the following table are given the data obtained in the different factories according to the machines used; the effect of distance upon the cost of the raw material has also been taken into account.

The difficulty of finding "gratteurs" to feed the "gratter" has led to the use of an automatic feeder increasingly necessary, and a small automatic feeding machine is being constantly enquired for, in order to bring the cost of production still further.

Average Cost of Production per Ton of Dry Fibre.

	Factory with water power			Factory with electricity			Factory with steam								
	£	s.	d.	£	s.	d.	£	s.	d.						
Cutting leaves	2	5	0				2	5	0						
Transport of leaves to factory	1	5	0	to 2 0 0	1	5	0	to 2 0 0	1	5	0				
Feeding leaves to grattes		8	0			8	0			8	0				
Decorticating	2	13	4			2	13	4			2	13	4		
Skins for gloves for gratteurs		0	0			0	0			0	0				
Removal of residue		4	0			4	0			4	0				
Fuel, oil and atten- dance	1	0	0			2	0	0			1	0	0		
Transport of green fibre to Louis		3	0			3	0			3	0				
Soap	1	3	4			1	3	4			1	3	4		
Washing		3	0			3	0			3	0				
Drying		8	0			8	0			8	0				
Brushing		8	0			8	0			8	0				
Baling		8	0			8	0			8	0				
Transport to Port-Louis	7	0	0	to 1 0 0	7	0	0	to 1 0 0	7	0	0				
Miscellaneous		8	4			8	4			8	4				
Total	£11	0	0	to 12	8	0	12	0	0	to 13	8	0	14	0	0

The exportation of fibre from Mauritius reached its maximum in 1912, being 3105.3 metric tons. In 1913, it was 2912 tons. From 1896 to 1912 the average export was 2134.4 metric tons and its average yearly value £45,300.

VARIOUS INDUSTRIES

Industry is worked on very small capital and therefore it does not much might be expected, considering the suitability of soil and climate. Wider plantings, the centralisation of factory work would be desirable, and it would pay to erect an up-to-date factory of which the cost is estimated at £3 000 to £3 500. The cost of planting and bringing to bearing, including expenses of supervision might be estimated at £100 for areas of 100 acres or upwards.

Efforts to establish for Mauritius fibre a reputation in the world's market for grading of fibre according to length, colour and strength should attract serious attention.

The Canned Fruits Industry in California, United States.—BENCKY, C. H. *Monthly Bulletin of the State Commission of Horticulture*, Vol. IV, No. 8, pp. 301-308. Sacramento, California, 1915.

The writer mentions the fruits that are of chief importance to the canning industry in California. The following is a brief summary.

Apples.—*Newtown pippins* are the best and the greater part of the fruit consumed annually in California consists of this variety. They are packed up in large tins for hotels and pie bakers, peeled, cored and quartered for use. A limited quantity is packed in smaller tins for use as apples, the undersized fruit is largely used for the pie grade, and the average price paid is from \$10 to \$12 per ton. The apples for canning come largely from Sonoma, Santa Clara and Santa Cruz counties. **Pears.**—*Bartlett* pears are in great demand and canners use ordinarily 125 000 tons per annum.

The price ranges from \$30 to \$40 per ton, sometimes in years of light crop rising to higher figures. Canners require the fruits to be free from scale and worms and not less than 2½ in. in diameter. In preparation the fruit is peeled, halved and cored, and is graded over and worked up again, for it is better when picked before ripening. This variety seems to give the grower the best results for years to come, for it arrives in good condition and is in great demand on the market being much liked also by preparers of dried fruit.

Apricots.—The *Royal*, *Blenheim* and *Hemskirk* varieties give the best results. In a normal season, 20 000 tons are canned. The average price for the last five years at the cannery has been \$30 per ton. Fruit of good colour, a clear skin, golden colour and firm texture is desired. As a rule, apricots are canned unpeeled, as the skin gives a peculiar flavour, and often the canner is very particular about apricots being free from fungus or bluish. The *Moorpark* variety which is much prized for its flavour, has the disadvantage of ripening unevenly.

Peaches.—The canner wants a peach of golden colour, of good size, without blemish, without colour at the pit, and with a small pit. For these qualities of the freestone varieties he prefers the *Muir* and the *Lovell*. These varieties usually command a higher price than the other freestone varieties. Although it ripens in late August, when the canner is overtaxed with other varieties of fruit. If a peach similar to the *Lovell* could be developed to ripen in July, or in the middle of September, it would be in high favour.

About 24 000 tons are canned annually with prices of about \$22.50 for *Lovell*, and \$17.50 for other varieties, like the *Muir* and *Lemon* *Clingsford*. Other varieties which may do well for shipping purposes, like *Underlander*, *Hale Early*, *Mary's Choice* and *Picquets Late*, are not adapted for canning.

In spite of the increased difficulty and expense of removing the seeds, yellow clings are the most desirable of all Californian canned clings; more of these are canned, than of any other variety. Different varieties have been propagated from the original *Lemon Cling*, so that the season gets an almost continuous season from late July to late September, beginning with *Fuscans*, *Orange*, *Mc Kevitt*, *Sellers* and *Phillips* and ending with *Late Levy* clings. The first and the two last are the most popular; the average price for *Phillips* and *Fuscans* is about \$8.25 per ton, and for the other varieties \$20. As with the freestone peaches, the clings are graded, sized, halved and pitted. About 35 000 tons are used annually for canning. The *White Heath Clings* were formerly quite popular, but did not ripen early enough to suit the canners, while *George's Late*, which was grown in the same season, was not satisfactory to the consumers. A good white cling, like *Mc Kevitt*, if it ripened in September, would fetch a higher price than the yellow clings. About 900 tons are, at present, used for canning.

PLUMS. — *Egg plums*, *Greensave*, *Golden Drop* plums and other varieties are used to a limited extent for canning; about 2500 tons are used annually and the price is usually from \$15 to \$20 per ton. They are merely stemmed, graded and washed and is packed whole without pitting or pitting. Buyers object to the coloured varieties, as they discolour the syrup.

CHERRIES. — About 1 200 tons of *Royal Anne* and white varieties are used annually for canning and probably about 450 tons of black cherries. The average price of the former is from 5 cents to 6 cents per pound; the latter only fetch about $3\frac{1}{2}$ cents or 4 cents per pound. They demand a clear transparent syrup, and for this reason black cherries are less used for canning. *Royal Anne* cherries, when grown in this State, are waxy and white and therefore are the most prized. The greatest crop has come from the north central counties of California and are bought by shippers and by packers in Maraschino, as well as by canners.

GRAPE. — The Muscat, or raisin grape, is canned to a limited extent; about 1000 tons are used annually at a price of about \$12 to \$15 per ton.

BLACKBERRIES. — Blackberries are used extensively by canners, about 1000 tons being tinned annually. The *Mammoth* and *Laxton* varieties are the most common and fetch about \$40 per ton. Far better results are obtained with *Loganberries* (a hybrid between the blackberry and raspberry); the price of these fruits ranges from \$55 to \$75 per ton; they are in great demand in the fresh fruit market, as well as with the canner and for the manufacture of dried fruit. Canners use about 750 tons; the *Phenomenal* variety is to be preferred. In the dried form, loganberries are likely to sell at about the price of the dried raspberries, they sell for some 23 cents to 25 cents per pound.

The canning industry has not yet found a variety of strawberry

of sufficiently firm texture and high colour. The varieties grown are more suitable for jams and jellies than for preserves. One of the Alviso and Santa Clara districts has become too small for export to the canner, or consumer. These varieties ordinarily bring \$70 per ton, while the *Clarke*, *Wilson* and other similar varieties grown in Oregon bring \$100 per ton, being more hardy and better adapted to the can. About 800 tons are used by canners and preservers, but a much larger quantity could be employed of better varieties. The *Cuthbert* and other varieties of raspberries are commonly grown; canners use 100 tons annually, but more would be used if prices were nearer acceptable to growers in Oregon and Washington.

Blackberries are used to a limited extent for jams and jellies. If the English gooseberry grown in Oregon were produced in California, it would pay a high price.

Blackberries, a small white fig of good quality is grown which is canned to a considerable extent; there would seem to be an opportunity for developing this in California.

The method generally employed in the canning industry is as follows: Fruit, properly prepared, is put into the can *ad hoc*; sugar syrup is added, merely for flavouring, and the can is hermetically sealed and sterilized by heat.

The Cause of the Loss of Nutritive Efficiency of Heated Milk. McCORMICK, E. V., and MARGARET, Laboratory of Agricultural Chemistry of the University of Maryland. In *The Journal of Biological Chemistry*, Vol. XXIII, No. 1, pp. 241-264, Baltimore, Md., November, 1905.

In order to learn what factor is involved in the loss of efficiency of milk by heating, a series of feeding experiments was made in which a polished rice (previously heated at 15 lbs. pressure in an autoclave) was given in varying amounts, butter fat, and a salt mixture, was supplied with heated preparations from milk as follows:

- (1) Milk from which the casein had been removed (whey), heated in autoclave.
- (2) Milk from which the casein and albumin had been removed, boiled six hours.
- (3) Milk (not heated in autoclave).

The following conclusions were reached:

- (1) Skim milk powder which has been wet and long heated in a double boiler or heated for a period of one hour in an autoclave at 15 pounds' pressure no longer supports growth as does the unheated product. When milk powder also loses its property of supplementing certain rations made up of polished rice, plus salts and butter fat; *i. e.*, rations which require both protein and water-soluble accessory to make them support

Wheat embryo, which is as efficient as milk powder in supplementing rice rations, can be heated for one hour in an autoclave at 15 pounds' pressure without manifesting any deterioration in this respect.

Skim milk from which the casein has been removed (whey)

can be heated in an autoclave at 15 pounds' pressure for one hour without noticeable loss of its nutritive properties. It still supplies the water-soluble accessory in active form.

4. Whey from which the albumin has been removed by coagulation can be kept at the boiling temperature for six hours without any noticeable loss in its activity as far as the water-soluble accessory is concerned. Also lactose which has been heated in an autoclave for one hour at 15 pounds' pressure, still behaves as does the unheated product in supplying to rations the water-soluble accessory.

5. Heating casein, in a moist condition for one hour in an autoclave at 15 pounds' pressure destroys its biological value as a complete food.

6. Heated casein or heated milk powder are shown to have no toxicity. The deterioration is due to a loss of value of the water-soluble fraction of the ration through changes wrought in the casein.

242 - **Researches on the Proteolytic Action of Lactic Ferments.** — GORINI, C., in *Atti della Reale Accademia dei Lincei, Series I*, Vol. XXVI, No. 10, pp. 470-471, December 7, 1915.

In a previous paper (*Rendiconti dell'Istituto lombardo di scienze e lettere*, 1907, p. 947; 1908, p. 122) the writer in describing a type of acid non-producing bacteria isolated from the cows udder, gave the first example of a lactic ferment showing proteolytic action only in milk and not in gelatin cultures. In a later paper (*Rendiconti della R. Accademia dei Lincei*, 1910, p. 150) a second example is given in describing a type of acid non-producing coccus isolated from cheese. Thus the inability to liquefy gelatine is a sufficient criterion of the absence of peptonising action in a lactic organism on the casein of cheese. It is shown that this difference in behaviour is not attributable to a difference in the proteolytic enzymatic action on the gelatin and that acting on the casein. If some drops of a peptonised lactic culture of these bacteria are added to sterile gelatine and kept for several hours at ordinary temperatures or even in ice, the gelatine is liquefied, thus proving the peptonising action of the proteolytic enzyme in the lactoculture.

The writer at first considered that this difference in behaviour was due to the fact that the gelatin was not sufficiently favourable to the development of the bacteria, but other types of lacto-caseolytic ferment were found to be unable to liquefy gelatine though they grew vigorously in it. Another interpretation was therefore necessary.

The researches carried out with this object are summarised as follows.

The influence of the substratum on the proteolytic activity of lactic ferments is confirmed. It is particularly obvious in comparing the behaviour of certain lactic ferments in gelatine and milk culture. Thus when the milk becomes peptonised, the gelatine is not liquefied, though the proteolytic enzymes of milk show peptonising action on gelatine. This influence of the medium is also seen in comparing the behaviour of the lactic ferment in liquid milk and in solid agar-milk cultures. It follows that the casein action of certain lactic ferments is uncertain owing to indefinite cause.

power is dependent on changes taking place in the milk before, during and after its utilisation in the laboratory.

The percentage of soluble albuminoids (peptones) in milk is one of the factors influencing the uncertain activity of the caseolytic activity of the lactic ferment. Especially in the case of retailed milk. By analogy it may be inferred that the variability of certain lacto-caseolytic ferments to liquefy nutrient media is due to the soluble albuminoids (peptones) that they contain, and that the stimulus producing the proteolytic enzymes in certain lactic ferments is subordinate to the necessity of producing soluble nitrogen for their own needs. When the soluble nitrogen is already present in sufficient quantity in the medium, the dissolving enzyme is no longer necessary. The latter may be the correct explanation, it is certain that to judge the dissolving power of a lactic ferment both gelatine and milk cultures are necessary. Experiments should be made with various quantities of milk, and to account particularly the differences there may be between fresh and retailed milk, especially with regard to the percentage of soluble albuminoids due to bacterial and enzyme action.

Comparing the previous results obtained by the writer (*Rendiconti della Accademia dei Lincei*, 1915, 24, p. 390) on the influence of temperature on the caseolytic action of lactic ferments, it is obvious what precautions are to be taken before the caseolytic power of a lactic ferment in an acid medium is employed; and how it may be assumed that this power is more widely distributed than appears from the experiments carried out without recognising differences.

Rational Preparation of Rennet from the Stomach of the Calf, Sheep and Goat.

Cited in *L'Industria Lattiera e Zootecnica*, Year XIII, No. 24, p. 370, Reggio Emilia, September 18, 1915.

The old method of preparing rennet paste consisted in drying the stomach and its caseous contents, cutting it into small pieces and mixing with water after which it is moistened with water to form a consistent paste and is left to stand for some time to increase its coagulating power.

The rational method requires a thorough cleaning of both surfaces of the stomach, since the active ferment is secreted by the membrane and not by the contents. The dried stomachs for the preparation of liquid rennet or in the form of rennet are known as "pellettes" in commerce. The essential condition in the preparation of the "pellettes" is that the animals used should be fed entirely on milk, otherwise the coagulating power of the rennet diminishes considerably.

The "pellettes" should be prepared in the following manner:

- (1) Take the abomasum from the freshly killed animal and remove all the contents of the casein.
- (2) Remove all adhering fat.
- (3) If the abomasum is dirty, it should be washed lightly and rapidly with clean water.
- (4) Tie the one of the open ends of the stomach with a thread and inflate with air from the other end.
- (5) Whilst inflated, tie the open end and hang up the balloon to dry.

6) When completely dry, remove the threads and com until completely collapsed.

In this form the "pellettes" are ready for use and a dozen or hundred. They keep well for several months when dampness, heat and maggots. Their coagulating power increases with age up to a certain point, after which it decreases completely.

AGRICULTURAL
PRODUCTS:
PRESERVING,
PACKING,
TRANSPORT,
TRADE

244 The Spontaneous Heating of a Heap of Oats. — HOFFMANN, J.

Zeitschrift für Tierkultur. Year 37, No. 52, pp. 510, 510. Berlin, December.

An article on the spontaneous heating of a heap of oats of cubic content was 527 cubic yards. Some of the oats had been before they were completely ripe and, at the end of November, the temperature of the heap was so high that it was feared that combustion would take place. With the object of ascertaining is more profitable to feed such fermented oats to cattle, or to raw material for distilling, the writer studied the spontaneous heating of the heap of oats. He chose 6 different samples, of which the water varied from 8.7 per cent to 22.1 per cent. The lighter-colored were distinguished from the darker coloured by their smaller black oats. Generally oats of every shade from light brown to black be observed. All the 6 samples had a characteristic and slight (especially the straw) which was probably due to the presence of and of formic acid (this question has not been thoroughly studied). In some cases, however, the acid smell was concealed by the odour of other substances (formaldehyde, etc). The black had a strong and disagreeable acid flavour.

In order to determine whether the oats in question could be distilled, the writer made a fermentation test with 4 samples of from the above-mentioned heap. From 220 lbs of raw material he obtained the following amounts of alcohol:

	1	2	3	4
Alcohol, millibars	1.72	1.29	2.17	1.83
Yield, per cent	7.0	5.8	9.6	7.9
Increase in yield due to spontaneous heating (per cent)	71	52	44	24

Sample No. 1 was of a black colour and damp; No. 2 was black; No. 3 was light-coloured and damp; No. 4 light-coloured. On comparing these results with the feeding results, it was found which had become heated spontaneously were more suitable as alcohol than for using as a cattle feed. If such oats must be they should be mixed with undecayed oats.

The primary cause of spontaneous heating is water. The water content, the greater the respiration of the vegetative cells, the more the temperature of the heap rises. This phenomenon is due by the large amount of fatty matters present in the oats. At his

oxygen, and the latter in its turn absorbs large quantities of oxygen, thus encouraging oxidation. Together with oxidation, there is a large formation of carbon dioxide, which, in its turn, also absorbs large quantities of oxygen, thus encouraging oxidation. All these different factors often raise the temperature of the heap of oats to such a height that cases of spontaneous combustion are produced.

(6) **Maize in Rhodesia.** — *The Rhodesia Agricultural Journal*, Vol. XII, No. 1, 1914, p. 10. Bulawayo, Rhodesia, October 1913.

The Government has endeavoured to facilitate the export of this year's large surplus of maize in order to meet the internal requirements, and in particular to aid the Farmers' Union of Rhodesia and other exporters in their endeavour to establish a reputation for the highest kinds of quality of grain to place on overseas markets, the Government of Rhodesia has this season, for the first time, employed graders to go throughout the grain districts and examine every bag of the imported and local maize at the railway stations and sidings where they were to be entrained. Graders' certificates have been issued for Flat White No. 1, Flat White No. 2, Flat White No. 3 and Flat White No. 4, these being the classes registered in Europe at the various ports of call, where samples are deposited for the buyers' guidance. The mark on the bag, is the buyer's guarantee that the grain is up to standard. The percentage of rejected bags has been very small. The reasons leading to rejection have been dampness, dirtiness, carelessness in handling and too high a proportion of discoloured and broken grains. The difficulties of the work the first year have been considerable, principally owing to the irregular delivery of grain. All this work has been done without any charge, but the results have been so satisfactory as to repay the labour expended.

(7) **Cantaloupe Marketing in the Larger Cities with Car-Lot Supply, 1914.** — SUMMERS, J. H., and YEAZ, L. L., in *U.S. Department of Agriculture, Bulletin No. 212, Cantaloupe Marketing in the Larger Cities*, Washington, October 1914.

The Bureau of Markets and Rural Organisation of the United States Department of Agriculture has published the data collected by an enquiry into the marketing of cantaloupes in the United States. It was sought to determine the route followed for a certain number of car loads of cantaloupes from the point of production to the consumer, records were made of all changes in possession or ownership and of added charges. In the endeavour was made to secure the following items of information: name and initials; point of origin; consignor; consignee; selling fees; marketing association; distributor; local buyer, or solicitor; date of arrival on market; date car was opened; date released; date of refrigeration; demurrage; condition of stock on arrival; cartage charges; gross profits of brokers, wholesalers or commission merchants and net profits.

In addition to the above work on car loads observations were made of the factors which affected the cantaloupe market, either favourably or unfavourably.

SYSTEMS OF DISTRIBUTION WITHIN CITIES.

Where investigations were made, it was found that the channels of distribution after the car reached its destination follows:

I	II	III
1. Broker.	1. Broker.	1. Wholesaler or merchant.
2. Wholesaler or commission merchant.	2. Jobber.	2. Jobber.
3. Jobber.	3. Retailer.	3. Retailer.
4. Retailer.	4. Consumer.	4. Consumer.
5. Consumer.		

Many firms in the smaller markets combine the functions of wholesaler and jobber by selling either to the jobber or the retailer as a rule being higher the smaller the quantities sold.

In most markets the broker figures more prominently in the distribution of western cantaloupes than of eastern stock. The practice of buying of eastern cantaloupes is probably explained by their lower cost compared with that of western stock.

FACTORS WHICH INFLUENCE PRICES.

The daily arrival of car lots of cantaloupes naturally plays an important part in determining prices. On the average large market these are from several widely separated sections. Cantaloupes from California come on the New York market with those from Maryland; a section distant more than 3,000 miles competing with a shipping area only some 200 miles. On August 15, Texas points, 2,100 miles distant from New York City, are sending their melons to compete with those from New Jersey. New Mexico and Nevada compete with Indiana and Illinois on the Chicago market. About the middle of August in Chicago the melons from eight different States were competing with each other.

This is rendered possible by transportation and refrigeration facilities. The question of competition narrows itself to a comparison of quantity and quality of the melons and the difference in freight and warehouse rates from the competing areas. If the melons from California are not superior in some way to those from Delaware, Maryland, and Michigan, they cannot profitably enter the same market unless the cost of production is sufficiently low to offset the increased freight and warehouse charges. The superiority of cantaloupes grown under irrigation is well recognized in all the larger markets.

The tables given by the writers of car-load freights and tolls from several cantaloupe shipping sections to twelve of the large markets show to what extent the cost of carriage allows the various centres of production to compete with each other.

the numerous packages used for cantaloupes in the various markets that are used with best results are the "standards", holding 10 to 15, and the "flats", holding 9 to 15.

great fluctuations in the demand for cantaloupes occurred, due to sudden changes of temperature in the Eastern markets and competition of other fruit that flowed in abundance to the great market. The sale of melons difficult towards the end of the season which lasted 2 to 5 months.

Data collected by the Market Surveys Bureau for a few carloads and following the changes in prices of the goods from the producer to consumer cannot be generalised and are only illustrations of the spectra that were examined. The great range of gross profits on the sales of cantaloupes is striking. It was found to vary from 28.8 to 68 per cent for those in standards and from 33 to 130 per cent for those in flats. The average gross profit per crate varied from \$0.627 for the former and from \$0.177 to 0.755 for the latter.

From the enquiry made in the spring of 1915 on the 1914 cantaloupe crop it appeared that about the middle of May the first important shipment of cantaloupes were made from the Imperial Valley in California, these followed closely by shipments from Florida and southern Texas and Arizona. The last being those from Colorado which begin about the middle of August and continue till the end of September.

Figure 1 shows the cantaloupe shipping stations together with the number of carloads sent from them during the 1914 season. The Report contains charts and diagrams showing the shipments from each county, the opening of the fruit and the duration of the productive period in each State and from these data the writers have drawn a map like the one given below with No. 237.

TABLE I.

State	Carloads	State	Carloads
California	5146	Nevada	306
Florida	2860	Michigan	300
Georgia	1269	Texas	271
Arizona	1243	N. Mexico	212
Colorado	1120	S. Carolina	203
Illinois	923	New Jersey	110
Ohio	885	Virginia	73
Alabama	528	Tennessee	52
Arkansas	453	Missouri	29
South Carolina	399	Utah	24
Washington	325	Washington	22

Peach Supply and Distribution in 1914. — SHERMAN, W. A., WALKER, H. F., and L. H. in U. S. Department of Agriculture, *Bulletin No. 218 Office of Markets and Com. Division*, pp. 1-15. Washington, August 31, 1915.

The peach season in the United States extends from the middle of May, when shipments begin in Florida, to the latter part of October, when they

end in the Northern States. California, with its diversified climate, has a great number of varieties of peaches, probably has the longest season, *i. e.* from the middle of May to the end of September.

For the study of the trade of the peach crop from the shipping States to the great markets the writers propose grouping the various States as follows:

- 1) South-eastern — Including the Carolinas, Georgia, Alabama, and eastern Tennessee.
- 2) South-western — Including Texas, Louisiana, Arkansas, Oklahoma, and Missouri.
- 3) Eastern — Including Virginia, West Virginia, Maryland, Pennsylvania, Delaware, New Jersey and Connecticut.
- 4) New York.
- 5) Lake Districts — Michigan and Ohio.
- 6) Mountain Districts — Colorado, Utah, and New Mexico.
- 7) California.
- 8) North-western — Including Washington, Oregon and Idaho.

The suggested grouping provides for practically all car-load shipments, except from a few localities of minor importance in Kentucky, eastern Tennessee, southern Illinois, Ohio and West Virginia. These might constitute a ninth group — the Ohio Valley.

The Office of Markets and Rural Organization, United States Department of Agriculture after a preliminary enquiry on the 1913 crop published now the results of the enquiry as to the 1914 shipments, obtained from railroad officials, shipping agents, co-operative organizations and others known to be interested in the peach trade.

The object of the enquiries were to ascertain: 1) the relative importance of the various centres of production in which peach growing is important as to amount of peaches being sold by car-loads in the great markets; 2) the time at which the shipping season begins in the various centres of production and its duration so as to know which of them compete with each other at the same time in the chief markets.

The ten leading States in the shipment of peaches in 1914, with their shipments of more than 1000 car-loads are as follows:

State	Car-loads	State
Georgia	1803	Colorado
California	2983	West Virginia
Washington	2501	New Jersey
Ohio	2340	Utah
Michigan	2200	Maryland

(Continued)

(Continued)

The other States shipped altogether 4705 car-loads, forming a grand total of 27,004 car-loads. In the tables given by the writers the numbers of car-loads sent by each county in the various States are reported.

The following diagram (fig. 1) shows in detail the comparative shipping season of the different States, and which of the latter can compete with each other in early or late produce.

It will be seen from the above diagram that the chief producing

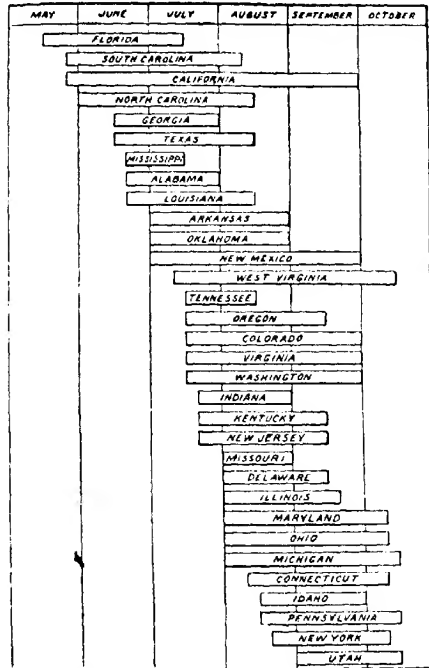
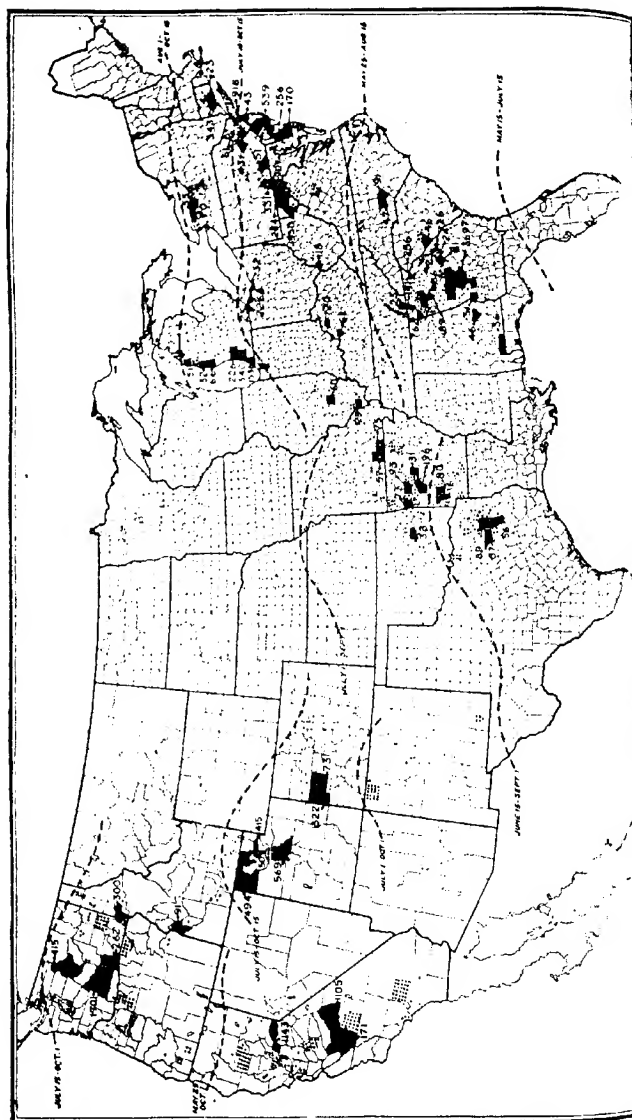


Fig. 1. Peach-shipping season.

of Georgia, exported its 4803 car-loads in a short period extending in the second half of June to the end of July, whilst California that follows immediately in number of car-loads namely 2083, shipped them between end of May and the beginning of October, and Washington, the third in point of importance of production began, its shipments at the beginning of July or only a fortnight before the end of the Georgia shipping season.



With the object of pointing out the importance that the great centres of production, rather than the States to which they belong, have from this point of view and from that of their production and to show the curves of the geographical boundaries of the individual epochs of shipping, the following map, fig. 2, has been prepared. Each dot represents five car-loads of production thereof. The black areas represent the number of car-loads indicated by figures.

For the 1915 crop, estimates were secured from 571 shipping points (228 States), which in 1914 had sent off 22 877 car loads. The estimates made indicated a total of 43 623 cars in prospect for 1915 or an increase of 90 per cent.

From the Bureau of Crop Estimates' report a production forecast for the whole of the United States was made of 58 328 000 bushels as compared with a final estimate last year of 54 100 000 bushels.

PLANT DISEASES

GENERAL INFORMATION

- CALITHES 245 - **Biochemical Researches on the Bacteriosis ("Rübenschwanzfäule") of the Sugar-Beet.** — BOBÁR, J., in *Kisérlet és Közlemények*, Vol. XVIII, Part I, 19, Budapest, 1915.

After a summary of the studies made by BUSSE, LINHART, FRYS, SORAUER, STIEF and others on the bacteriosis of the sugar-beet ("Rübenschwanzfäule") the writer describes the biochemical researches carried out in 1913. From the results obtained he draws the following conclusions:

1. The sugar-beet attacked by bacteriosis has a smaller percentage of saccharose and of water, while the percentage of invert sugar, ash, acid and alumina, is higher than in the sound beetroot cultivated in the same soil.
2. The presence of invertase may be demonstrated both in the diseased and in the sound part of the sugar-beet attacked by bacteria. It may be also obtained in a solid form.
3. It is probable that, in the diseased beet, the increased percentage of the inorganic compounds takes place before the bacterial invasion of the beetroot, and that this predisposition — if the theory of SORAUER regarding the origin of the disease be accepted — may be a sign of the weakened resistance of the plant. On the other hand, the changes in the percentage of saccharose and invert sugar, and also in the percentage of acidity, may be due to the vital action of the bacteria attacking the plant.

- 239 - **"Fumago" in the Department of Sotshi (Caucasus).** — VORONIKHINI, N. N. in *Trudy Buraua po prikladnoj botanike* (Works of the Department of Applied Botany attached to the Ministry of Agriculture), Year VIII, Vol. 6 (80), pp. 769-807, 1915, with text. Petrograd, 1915.

The fungi which cause the production of "fumago" on the leaves of trees are the most widely spread representatives of the mycological flora of the department of Sotshi. The writer's researches, made in 1912-13

that "fumago" is to be found not only on the coasts of the sea, but also on the higher ground, spreading sometimes over several square kilometers. The writer has identified, in the above argument, 11 species of small fungi which produce "fumago", new to science and are included in the genera *Antennulariella*, *Chaetothyrion*, and *Triposporium*: *Antennulariella Voronikhine* on *Hex aquifolium* L.; *Zakaita caucasica* Voronikhine on *Prunus laurocerasus* L.; *Z. setosa* Voronikhine on *Prunus laurocerasus* L.; *Chaetothyrion ponticum* L.; *Limaecina caucasica* Voronikhine on *Hex aquifolium* L.; *Chaetoblastium coddicum* Voronikhine on *Hex agrippifolium* L.; *Triposporium tenue* Voronikhine on *Rhododendron ponticum* L.; *Triposporium coddicum* L.

The diagnoses of the new species are in Latin.

On the **Composition and Preparation of Bordeaux Mixture.**—SISAKO, I., in *Travaux de l'Institut National d'Agriculture de Montpellier*, New series, Vol. XIV, Part III, Montpellier, 1915.

After his researches on the composition and preparation of Bordeaux mixture, the author arrived at the following conclusions:

1. The amount of lime necessary for rendering the copper completely insoluble is much less than that which most writers indicate. In actuality, when a solution of pure lime is poured slowly into a solution containing 10 g. of pure copper sulphate strongly stirred, the Bordeaux mixture obtained is acid only so long as the total of lime added is below 108.5 g., that quantity being expressed in pure quick lime (CaO).
2. When the quantity of lime added amounts to 108.5 gms. all the copper is rendered insoluble. The mixture is then "neutral" and "has no excess of lime". For larger quantities of lime between 108.5 gms. and 225 g. the mixture is still "neutral", but "has excess of lime".
3. When the quantity of lime is beyond 225 g. the Bordeaux mixture is "acid".

The so-called "neutral" Bordeaux mixtures prepared in the vineyard by adding lime until the blue litmus paper ceases to turn red, are mixtures with more or less excess of lime and whose antieyptogamic value is inferior to that of the neutral Bordeaux mixtures with no excess of lime.

4. To obtain a good Bordeaux mixture proceed in the following manner:
 - (a) Dissolve 22 litres of lime milk at 2 " in 22 gallons of water.
 - (b) Dissolve 2 kg. of copper sulphate in 50 litres of water.
 - (c) Take a volume of lime milk containing pure lime in a sufficient quantity to render insoluble all the copper of 2 kg. of copper sulphate in 50 litres of water.
 - (d) Increase the volume of liquid to 50 litres.
 - (e) The average volume of lime to be taken will be:

$$\frac{22 \times 100}{100 - 108.5} \text{ litres of lime milk at } 2 \text{ "}$$

$$= 24.2 \text{ litres of lime milk at } 2 \text{ "}$$

$$+ 22 \text{ litres of water}$$

$$= 46.2 \text{ litres of Bordeaux mixture}$$

3) Pour the copper sulphate solution very slowly into the mixture, stirring it quickly either with the hand or, better, with a mechanical stirrer. The more slowly the copper sulphate is added, and the longer and more strongly the ingredients are stirred, the better will the Bordeaux mixture succeed.

Generally, as soon as all the copper sulphate is added, the mixture is acid, but shortly afterwards, when the action of the lime is enabled to be so. The Bordeaux mixture is then neutral and without lime.

This mixture is pale blue and may be kept indefinitely without deteriorating.

241 Sterilisation of Seeds by Calcium Hypochlorite as Means of Controlling Diseases Spread by Seeds. See above No. 162.

DISEASES
OF VARIOUS
CROPS.

242 A new Bacterial Disease of Western Wheat Grass (*Agropyron Smitii*). O'FARRA, P. J., in *Science*, New Series, Vol. XLII, N° 1087, pp. 640-641, 1913, Pl. 1, fig. 1.

The writer reports the presence of a very unusual type of bacterial disease occurring on "western wheat grass", *Agropyron Smitii*, hitherto unnoticed in the Salt Lake Valley, Utah. The affected plants are usually somewhat dwarfed, the most striking characteristic of the disease being the presence of enormous masses of surface bacteria which form a lemon yellow ooze or slime on the aerial parts of this plant. Sometimes bacterial slime appears in small droplets, spreading over the sheath, internode and inflorescence. The glumes which are badly attacked by bacterial layers of slime between them and the floral spikelets, while the disease does not attack the roots, lower internodes and sheaths. The disease produced a premature drying and bleaching of all the parts of the plant covered by the bacterial ooze. This disease has many characteristics in common with RATHAY's disease of orchard grass (*Dactylis glomerata*), caused by *Aphanobacter Rathayi* E. L. S., and described by RATHAY and SMITH.

The writer has in progress an extended study of the disease and the causative organism.

243 *Ustilago Arrhenatheri* (= *U. dura*?) on French Rye Grass (*Arrhenatherum elatius*). SCHILLINGER, H. C., in *Bericht der Deutschen Gesellschaft, 17. Jahr*, Vol. 33, N° 7, pp. 310-323, Berlin, 1913.

While studying some diseased specimens of French Rye Grass (*Arrhenatherum elatius*), the writer noticed upon them two species of *Ustilago*, *U. perennans*, a well known fungus described by ROSTKOPF, and a species entirely distinct from the first, which he calls *U. Arrhenatheri*.

The spores of this *Ustilago* are enclosed in the grains; the grains are well divided and white. Taking hold of the spores with the finger and thumb, resistance is noticed. The spores measure from 5 to 8 μ , their surface is smooth. *U. Arrhenatheri*, damages the flowers less than *U. perennans*, but it makes no distinction between the flowers completely enveloped and those that are not. In the diseased flowers the floral spikes are smaller.

the colour of the spores is slightly darker than that of the spores of *U. arrhenatheri*; the spores are often stuck together.

On spore germination *U. Arrhenatheri* may be distinguished from *U. arrhenatheri* principally by the fact that its promycelium does not form a ball.

U. arrhenatheri is probably identical with *U. data* described in 1900 by GASSNER.

***Pleosphaerulina* sp. a new Alfalfa Leaf-spot in America.** METCAL, *Mycol. Soc. America, New series*, Vol. XLII, No. 1075, pp. 826-827, Lamar, Tex., Dec. 1, 1914.

In October, 1914, the writer's attention was attracted by the appearance of a alfalfa field in the vicinity of Manhattan, Kansas. Careful investigation showed that a leaf-spot was prevalent on many plants and that it was quite different from anything with which the writer was familiar.

The plants affected might be distinguished by the sparseness of the foliage, unthrifty appearance and the presence of the characteristic spots.

The disease was again located in the aforementioned field on April 17, 1915, in a number of fields belonging to the Kansas Agricultural College. Specimens were also collected in different localities in Kansas and in other States.

On study of the material collected leaves no doubt as to its pathogenicity. The fungus is an ascomycete belonging to the genus *Pleosphaerulina*, which has not as yet been reported in North America. Inoculation experiments are now under way.

The data are not as yet sufficient to identify this fungus with *P. Blumii* Pollacci which is the cause of an alfalfa leaf-spot in Italy, Austria and elsewhere. The spots are confined almost exclusively to the leaves, frequently along the margins, but the fungus sometimes attacks the roots also.

This disease, which causes the destruction of the foliage, may prove to be of considerable economic importance.

Researches on the Germination of the Late Blight of Potato (*Phytophthora infestans*) (10). METCAL, L. E., in *Experimental Environment Stations for the University of Wisconsin, Research Bulletin No. 37*, pp. 1-64, Figs. 1-8, Madison, Wisconsin, 1915.

The conidia of *Phytophthora infestans* may germinate either indirectly by the production of zoospores or directly by germ tubes. The type of germination is determined chiefly by external influences, such as temperature, moisture, and the medium in which the conidia are placed.

Temperatures below 20° C. have been found more favorable for zoospore formation in water, in which case the minimum lies between 2 and 1° C., the maximum between 24 and 25° C.; the optimum between 12 and 15° C. For direct germination the limits are all higher; it was very scanty at 15° C.; the minimum is between 10 and 13° C.; the maximum very abundant and the optimum about 24° C.

Indirect germination occurs generally in a 10 per cent dextrose solution, sparingly in a 10 per cent solution, and not at all in a 20 per cent solution. Indirect germination is replaced by some direct germination at the mentioned strength. The time required for the spores of *Phytophthora* to germinate is usually from one to three hours. The shortest period for direct germination was 15 minutes. Direct or tube germination is a long process and also is dependent upon the temperature. Eighty per cent of the conidia germinated at temperatures between 10 and 15°C.; higher or lower temperatures the percentage decreased. These temperatures, changing from high to low, or vice versa, do not greatly favor germination.

The period of motility of the zoospores was also influenced by temperature. Its duration varied inversely with the temperature, ranging from 20 hours at 5-10°C. to 10 minutes at 24-25°C. The further development of the zoospore after coming to rest, i. e., growth of germ tubes, is rapid at 24-25°C. than at lower temperature.

A frost that kills the tissues of the host plant is also sufficient to kill the conidia of *Phytophthora*. Leaf juices resulting from the same infected tissues have an inhibiting effect on germination. Light, direct or diffuse, does not hinder germination so long as the temperature is not above the optimum.

Indirect germination takes place in the morning dew and rain on the foliage under field conditions. Increasing the amount of moisture in the medium containing the conidia does not stimulate germination; on the contrary inhibits it. It may be that sufficient oxygen exists in the conidia to allow indirect germination to take place.

The writer has also carried out studies on the toxicity of certain fungicides. When the conidia were subjected to optimum temperature conditions for indirect germination, 0.0150 per cent of copper was necessary to prevent germination.

In these conditions, copper acetate, copper nitrate or cuprous chloride produce the same effect, while cuprammonium sulphate is about 10 times as toxic as the other copper salts tested.

Calcium polysulphide (1 : 21.7) and sodium and potassium polysulphides at one per cent prevent germination.

The conidia of *Plasmopara viticola* were slightly more resistant to polysulphides than those of *Phytophthora*.

The most favorable temperature for the growth of the mycelium of the tissue is about the same as the optimum for direct germination, 15-20°C. Infection may take place through either the upper or lower surface of the leaf.

Generally the lower surface of the leaf is most susceptible, this is due to the difference in the number of stomata which are about 10 times more numerous than on the upper surface.

A rich bibliography follows.

***Spongospora subterranea* ("Powdery Scab of Potatoes") in Oregon.**

(1) in *Scientia*, New series, Vol. XLII, No. 1481, pp. 111-120, London, 1931.

Spongospora subterranea scab disease of potatoes has recently been reported in Tillamook County, Oregon. It seems to be the first time the disease has been noticed west of the Rocky Mountains (1). Infected tubers, examined and identified by the writer in April 1932, were found on a farm in the coast district of Oregon referred to above. The variety of this variety had been introduced from twelve to fifteen years ago and new seed had not been introduced since that time. The specimen was picked up in a grocery store at Tillamook. The fact that the district is isolated and that potatoes are not raised in great quantity for export possibly has been a natural means of preventing more general dissemination of the disease.

***Pestalotzia Palmarum*, Injurious to the "Cinnamon Tree" (*Cinnamomum zeylanicum*) in the Federated Malay States.** SHARPLES, A. H. (2).

(2) in *Journal of the Federated Malay States*, Vol. III, No. 1, Singapore, 1931.

Terminal bushes of *Cinnamomum zeylanicum* growing in the Experimental Gardens at Kuala Lumpur have been attacked by a disease whose symptom is the death of one of the branches. The rest of the bush remains healthy but ultimately other branches begin to die off. The leaves remain attached. An affected branch shows the whole cortex to be diseased. This diseased cortex is dark-brown in colour. Sections of this diseased cortex showed the presence of a fungus—*Pestalotia palmarum*—a common parasite on the coconut palm but dangerous to the coconut only when the trees are growing under unfavourable conditions. Sclerotia of the fungus are embedded in the rotting tissues of the wood and when the cortex is completely disintegrated the spores are liberated and provide fresh means of infection. The tree may ultimately die, but the attacks of this fungus, in the case of the Coconut, can usually be controlled. The most effective method of preventing the spread of the fungus is to cut off the diseased branches below the affected parts and burn them immediately. *Pestalotia palmarum* is reported from Ceylon as attacking the leaves of Cinnamon causing what is termed "Grey blight".

***Alternaria Panax* the Cause of a Root rot of Ginseng (*Panax quinquefolium*).** ROSENBAUM, J. and ZINN-MELDER, C. A., in *Journal of Agricultural Research*, Vol. V, No. 1, pp. 187-189, Pl. VII XIII Washington, D. C., 1931.

While working with diseases of Ginseng (*Panax quinquefolium*) during the year of 1913, the authors obtained from a garden near Cleveland, Ohio, tubers which showed a peculiar dry rotted condition about the crown. The dark-brown centre of the lesion was more or less sunken and firm to touch and gradually shaded into the yellowish white colour of the healthy root. This form of dry-rot is distinguished from others by its

(1) The above was written till the disease was noticed on potatoes in British Columbia, Vancouver, 1932.

lack of odour and the fact that the rotted roots never become soggy, the rot is near the crown of the root, the top of the plant often showing signs of disease. These signs are a wilting and yellowing of the leaves, which readily drop off on being disturbed. Such conditions may, however, be caused by other root-rots attacking ginseng, as, for example, the one caused by *Phytophthora Cactorum*.

In numerous isolations made from these lesions, an *Alternaria*-like fungus closely resembling *Alternaria Panax* Whet. was secured, both in pure culture. In order to determine whether these two fungi were identical, a series of inoculations on roots and tops were made with both fungi. In addition, a study was made of their macroscopic and microscopic appearance.

Inoculations were made with the *Alternaria*-like fungus and with *Alternaria Panax* not only on portions of tops and roots, but also directly in the soil on roots to which the tops were still attached. In all cases the results were definite and with identical effects; rotting of the roots and appearance of the typical leaf-spots on the leaf margin. The two fungi under consideration are therefore identical and, contrary to what has heretofore supposed, *A. Panax* is able to cause a root-rot.

The study of this disease leads to the conclusion that the best preventive means are:

- 1) care in transplanting so as to injure the roots as little as possible, as roots having the cortex and epidermis intact are not susceptible to infection.
- 2) the removal and burning of all diseased tops and stems in autumn.

249. **On a Fungoid Disease of the Fruit-bearing Branches of the Raspberry in Switzerland.** OSTERWALDER, A., in *Schweizerische Obst- und Gartenbau-Zeitung*, 1915, pp. 278-279, 1 Fig., Munsingen, 1915.

In several parts of Switzerland complaints have arisen about a fungus attacking raspberry plants in the spring; some of the fruit-bearing branches do not bud, or if they do they produce scanty shoots and discoloured leaves. Close to the root system, the diseased branches seem flattened and the appearance of having been choked, the tissues thereof are dead. The diseased branches as not to allow the water to pass properly from the roots to the budding tops. In summer, at the time the fruit ripens, spots are seen on the stems, which afterwards spread and penetrate causing the epidermis to fall off in the autumn. Under the epidermis, however, the winter buds remain, that the dark spots remain, being due to the presence of a thick mycelium which causes the fall of the epithelial tissues. This mycelium seems to develop, conditions being favourable, also in the winter and spring and causes the deformation and mischief already mentioned.

The specific agent of the disease seems to be either *Diplodia* according to E. MACHERAUCH or *Hendersonia Rubi* according to E. KESSELER. The writer has noticed, under the epiderm of the diseased portions of the brown fructifications containing a few spores of *Fusicladium* but the

the spores belonged to an unidentified species of *Cladophoma*; the writer believes this disease may be attributed.

Experiments are being carried out to obtain pure cultures and to test infection. As means of prevention, the treatment proposed is in summer and autumn the application of ferrous sulphate; of sulpho cal; of lime; or even of carbolineum.

Research for immune varieties does not seem hopeful; all varieties in Switzerland are more or less infected by this disease. The least infected seems to be the "Baumforth-Samling" variety.

Researches on Vine Mildew. Favourable Time for Treatment. RAVAZ, L. and G. in *Annales de l'Ecole Nationale d'Agriculture de Montpellier*, New series, 1913, Part III, pp. 116-120, Figs. 1-18, Montpellier, 1913.

The researches, which were carried out at Montpellier by the writers from 1910 to 1913, concern the germination of the winter spores, the length of their germinating faculty lasts, the proper time for treatment, etc. The conclusions were the following:

1. Summer and autumn conidia do not seem to remain alive on or under the ground during winter. They generally disappear, either because they are destroyed by insects or because insects destroy them.

2. The first infection is however due to the macroconidia, derived from the winter spores, which are scattered on the surface of the ground.

3. The appearance of these macroconidia is equivalent to the appearance of the white spots on the herbaceous organs; it may therefore be considered as the first stage of invasion, which develops, not on the vine, but on the ground.

4. If the zoospores of the macroconidia are carried to vines whose infestation is sufficiently advanced, they cause the initial infection, from which will be derived the second stage of invasion; but if the vine has not yet been infested they die without producing the disease, which may then manifest itself owing to the insufficiency of germs. This is the case of the vines.

5. To be effective, cupric treatments should cover all the parts to be protected at the time when the macroconidia make their appearance, that is, at the time of the invasions. In 1915 the advent of the conidia was preceded 5 or 6 days in advance by the "oil spots," a sufficient length of time for the spraying of all the vines. If this were always the case, the appearance of the oil spots would indicate the exact time for the treatment.

6. However, the oil spots are often wanting, and it is there that the disease is the most serious. In this case the advent of the conidia may be announced by:

7. The conidia themselves. It is then only necessary to produce on the suspected stocks the conditions of temperature and of moisture favourable to their appearance. This is done by covering some of the stocks with a bell and keeping the inside very damp. The appearance of the conidiophora is here the announcement of an approaching invasion without and the treatment should be applied. These researches should of course be only made on stocks which have not yet been treated.

2) The announcement may be given even sooner by the escape of the germs, i. e. the zoospores, which stimulate it. The existence of soil germs may be ascertained by a microscopic examination of the bearing winter spores which are in the vineyard, and of the outside (carried by rain or wind). These should not be collected in glass, but in a wide funnel placed over a decanter, where the spores and the drops of rain and dew will accumulate together. If in such conditions these conidia germinate, which is easily seen, they germinate the leaves and a new invasion is on its way. The treatment should be applied.

It is for warning Stations and intelligent proprietors to give directions, which need attention only in seasons of rain and of dews. Following along parallel lines these two methods, the writers, especially, the writers will endeavour to anticipate the invasion, to indicate sufficiently far in advance the favourable moment for the treatment.

251 ***Pinus rigida* and *P. arizonica*, New Hosts for *Peridermium* *pyriforme* in the United States of America.** HEDGECOCK, GEORGE GRANT. WILLIAM H. HILL, *Journal of Agricultural Research*, Vol. V, No. 7, pp. 253-262, 1915. Washington, D. C., 1915.

Peridermium pyriforme, which is the aecial form of *Cronartium pyriforme* (Peck) Hedge and Long, was collected by HEDGECOCK for the first time on *Pinus rigida* Mill., on June 10, 1915, near Essex Junction, Vt.

HEDGECOCK had previously found the uredinial and telial forms of the fungus in the same locality on *Comandra umbellata* (L.) Nutt. in July, 1913.

This find is important, since it may serve to clear up the mystery associated with the identity of the host in the case of the type specimen of *Pinus* spp., collected by J. B. ELLIS in 1880, possibly near Newfield, Me., ELLIS not being certain as to the locality. Since the telial form was collected by ELLIS near Newfield in 1870 and as *Pinus rigida* is the only species of pine in this locality known to be attacked by the fungus, it is very probable that this species is the host of the type.

MR. ROY G. PIERCE collected a number of specimens of *Per. pyriforme* on *P. divaricata* (Mill.) DuRoi de Cours, in several localities near Lake Umbagog, Me., during the month of June 1915. So far as the writers know only one specimen of the fungus has hitherto been reported on *P. rigida* by I. J. DAVIS in Douglas County, Wis. PIERCE has also found the uredinial form, *Cronartium pyriforme*, in July 1915, on *C. umbellata* in the same locality where he had collected *Per. pyriforme*.

LONG also has a specimen of this rust on *P. divaricata* collected near Lake Umbagog, Mich. This specimen was sent in with *Per. coniforme* which on this host produces typical globular swellings, while *P. pyriforme* causes the typical fusiform swellings.

LONG has, however, recently received a specimen of *Per. pyriforme*

Warreni *conforta* Lond. collected at Roscommon, Mich. which caused a globoid gall which was 6 cm in circumference and 2 cm in height.

June 1015, LONG received a fine specimen of *Per. pyritome*, taken from *Pinus rigida* Engelm. in Jacobson's Canyon, Crook National Forest.

This is the first time this rust has been reported on this host.

Per. pyritome causes three forms of disease on pines: a) with hypertrophy, common on *P. densata*, *P. pungens* Michx. and *P. strobus* Engelm.; b) causing a fusiform swelling on *P. strobus*, *P. warreniana* *conforta*, *P. incurvata*, *P. ponderosa* Laws., *P. resinosa* Engelm., *P. rigida*; c) causing the formation of globose galls on *P. warreniana* *conforta*, *Per. pyritome*, especially when weathered, usually resembles *Per. Complanata* with which HYPERCOCK found it near Essex Junction, Vt., where he found one specimen of the former and nearly fifty of the latter species.

A careful search for *Per. pyritome* will greatly extend the known range of the disease caused by it; it is probable that up to the present have been mistaken by collectors for *Per. Complanata* which it resembles.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS

Insects Injurious to Cereals, Leguminous Plants and other Stored Grains in Mauritius.

1915. FORMIGNEY DE CHARENTON, D., in *Proceedings of the Société de Médecine et de Pharmacie*, N. 2, 19 pp., 4 Plates, Mauritius, 1915.

A list of several insects, followed by morphological and biological native notes, and information on the nature and importance of the grains used, besides giving the preventive means in common use.

Platydema oryzae, the "rice weevil", attacks rice, maize and wheat: the adults penetrate into the grains, rapidly reducing them to dust.

Prosternon minutus, the "maize beetle" or "bamboo borer", has been found in Guadeloupe, in Java and in India as extremely destructive to rice. In Réunion, in Brazil and in Tahiti, it attacks various plants. In Mauritius it also causes much damage to maize kept in cobs. The eggs are deposited and tunneled bored into the grain by the female; the larvae hatch and eat the grain.

The writer reports also an hitherto unidentified microlepidopteron, the "grain moth", which attacks that cereal.

Plutella cahiritella, the "rice moth", has in Mauritius a preference for Saigon and Rangoon rices. Other kinds of rice are seldom attacked.

These insects are not injurious on account of the quantity of grain they consume, especially on account of the unsaleable state to which they reduce it, as they leave in them their excreta and their nymphal envelopes.

It is with the spun-up grain, thus rendering them unsaleable. In India it attacks especially rice and flour. In Egypt and in America, where it is named the "dried-currant moth", it attacks most of the dried

fruits, such as raisins, currants, and figs. It also attacks almond, and cacao beans.

Bruchus obtectus, the "bean weevil", *B. chinensis*, the "cowpea weevil", and *B. quadrimaculatus*, the "four spotted weevil", are continually appearing from India, with gram and different varieties of peas, and have become spread in Mauritius where they cause damage to several leguminous plants (*Cicer arietinum*, *Phaseolus vulgaris*, *Pisum sativum*, *Vigna Catia*, *Phaseolus indicus*). The newly hatched larva eats its way immediately into the interior of the pod and attacks the seeds which it eats partially before it forms the chrysalis.

Sitona signatus and *S. surinamensis*, the "saw toothed grain beetle", and *Tribolium ferrugineum*, the "flour beetle", attack indiscriminately all sorts of grains as well as bran flour and other foodstuffs.

251 : Pests and Diseases on Cultivated Plants in the Dutch East Indies in 1914

ROTHSCHILD, A. A. L., in *Mededelingen van de Landbouwkundige Proefstationen van Nederlandsch Oost-Indië*, 1915.

The writer gives information on some pests and diseases which appeared during 1914 in the Dutch East Indies. That year was characterized by a prolonged drought, therefore no serious fungoid diseases were noticed. Other insects, however, caused more or less important damages: *Aceria* sp., on different plants; *Lecanium viride* on coffee; *Homocidus* on tea plants and cacao's. The drought caused the loss of 100 "bouw" (13,125 acres) of rice, an area larger than the average.

The decree regarding the importation of fresh fruit from Amsterdam for preventing the introduction of the "fruit fly" (*Ceratitis capitata*) took effect on February 1st 1914.

Among the diseases and pests reported for the first time in the Dutch East Indies in 1914, the writer mentions: a rice disease caused by *Ustilago horrida* Takahashi (1), which has not as yet caused any serious damage.

A disease of the oil palm (*Elaeis* sp.) which shows a rotting of the leaves in the core of the young trees. The cause is not known. The damage is of slight importance.

Melissobaptis rufocinctalis Snellen (2) nibbles the flowers and young fruit of the coco nut trees. The damage is serious but has for the present been circumscribed.

In the two last chapters the writer gives a summary of the report received from professors of agriculture and other officials on the diseases observed on different cultivated plants and also a list of 38 phytopathological publications concerning the East Indies printed in 1914.

INSECTS
INJURIOUS TO
VARIOUS
CROPS

251 : *Crioceris melanopa* (*Lema melanopus*) Injurious to Oats and Barley in Hungary.

KATÓCSY, GY., in *Készlet és Készletmunkák*, Vol. XVIII, Part 1-17.

1916, Pl. XVIII. Budapest, 1915.

The writer first describes minutely the appearance and rapid multiplication of *Crioceris melanopa* (*Lema melanopus*) in Hungary. In 1914

(1) See B., Oct. 1914, N. 971.

(2) See B., Nov. 1914, N. 1235.

He recalled for the first time the larva of an insect which devastated the surrounding whole fields of oats and barley. This larva, which he called *Cr. melanopus*, which is the name given to it by Hungarian peasants, must be identical with *Cr. melanopus*. Since then *Cr. melanopus* made frequent appearances causing excessive damage. In 1883, the Entomological Station reported for the first time some larvae which had been destroying the crops in the district of Zemplén. In the same year the insect was reported in the district of Szilagy. From 1883 to 1888, however, only a few appearances occurred, and it was not until 1888, that it commenced to spread rapidly on a larger scale. That same year 12 districts were infested. In 1890 the spread was still greater and the insect attacked not only barley but even rye. The worst ravages took place in 1891, when 10 districts were invaded. The damage caused that year was valued for the whole country between 1 and 1 1/4 million pounds. The writer has compiled a statistical list of all the districts periodically invaded from 1883 to 1914; the total number was 47. In order to free the infested regions as promptly as possible, the Entomological Station undertook an extensive series of experiments. The means of destruction tested were: "Thimoth", extract of pyrethrum, and arsenate of copper. The extract of pyrethrum (2.5 %), applied in large quantities killed 75 % of the larvae. Its high price did not allow of its being used on too extensive areas. Arsenate of copper gave negative results. "Thimoth", on the contrary, gave excellent results in a 2 % aqueous solution when its percentage of use was not too much below 4.5 %.

The writer describes the life cycle of *L. melanopus* and enumerates its natural enemies, together with the preventive means employed hitherto. He draws the following conclusions: *L. melanopus* was known in Hungary as a dangerous pest to agriculture as early as the beginning of last century. It caused immense havoc at the beginning of 1890 and during the first years of last century. Although in Hungary this insect inhabits the regions it may also be found in mountainous regions, and where the climate is quite favourable to the cultivation of barley and oats.

The appearance of *L. melanopus* in swarms is periodical. Through a succession of years the infested zones become increasingly extensive and the damage reaches a maximum, after which it diminishes.

The writer believes that the periodical disappearance of the pest is due to its natural enemies.

L. melanopus is known also in other countries but it seems to be only injurious to agriculture in Austria, Roumania and above all in Hungary.

The advent of the insect depends on the early or late arrival of the swarms.

In normal conditions, the first insects begin to appear in the first half of April. They collect in large quantities on the young crops and feed and perforate the barley and oat leaves tracing lines of varying extent.

About two weeks after the arrival of the insect, numerous eggs may be seen. The mucus covered larvae hatched from the eggs lie in the middle of the leaf like strings of beads, they suck the leaves but do not perforate them.

forate them as the adult insect does; and they leave the skeleton of the epiderm of the under surface of the leaf. The nibbling of the insect causes blanching of the leaves. The infected places show in patches. The crops are most luxuriant. In about four weeks the larvae are well developed and descend to the ground to complete their metamorphosis, which takes about another two weeks. *L. melanopus* has only one generation in the year.

Besides *L. melanopus* also *L. lichenis* is known in Hungary as a very injurious insect, but is more rare.

The measures against *L. melanopus* consist in the capture of the insects in the spring and the spraying of the infested patches. The most satisfactory means of prevention among those tried by the writer are nicotine sulphate, "thanaton", and chloride of barium (4% solution). The two first give the best results when the nicotine content is 1.5% to 5 oz. per gallon of water. To ensure the adhesion of the solution to the barium, molasses may be added in the proportion of 4%. Of the other remedies, the last has been the least satisfactory.

251. ***Heteronix piceus* an Insect Pest of Lucerne, in Australia.**—The subject is treated in *The Journal of the Department of Agriculture of Victoria*, Vol. XIII, Part 6, p. 4; Figs. Melbourne, 1915.

During the last few months many lucerne-growers at Werribee suffered considerable losses by the depredations of insect pests. On each dying plant, 1 or 2 inches below the surface, numbers of Cock Grubs (*Heteronix piceus*, Blanch.) were found. In one spade-full of nearly two dozen grubs were observed. The surface of the ground, where the grubs were plentiful, was perforated with thousands of holes, all containing the insects.

The grubs live on the roots of native and other grasses. They confine themselves to particular patches of the soil, usually where lucerne has been rather plentifully used. When a lucerne crop is affected with these grubs it is advisable to have it cross sown, if possible, harrowed and then rolled. A small lucerne patch growing at the search farm at Werribee was attacked by the grubs. The above methods were used and the results were very satisfactory; the plants now throwing out new foliage. Reports have recently come to hand of grubs attacking wheat. The trouble is generally in patches. They quit a small space and then start on another one. They feed on the roots of plants and sometimes come up and destroy the foliage when their roots are a few inches or so in height.

As a remedy, the A. suggests cutting up lucerne, grasses, weeds etc., into small pieces, and dipping them into arsenate of lead (1 to 20 gallons of water). These poisoned baits could then be sown in the affected area.

***Apamea testacea* Injurious to Forage Plants in Sweden and Denmark.**

GRIMM, H. *Scania. Ussaströmmen. Tidskrift*, Year XXV, Part 8, pp. 21-22, 1891, Malmö, 1-18.

Apamea testacea Hübn. ("Grästostflyet") caused much damage to forage plants at Svalöf. The larvae nibbled the roots and the lower leaf-stems of *Festuca pratensis* L., *Polygonum pratense* L., and *Dactylis glomerata* L. The writer found larvae of this insect in a field of *Festuca ovina* L. at the station of N. Wrauns (Skåne).

A. testacea was reported at the same time in Denmark in the following localities: at Stevns, on *Dactylis glomerata*; at Roskilde, on *Festuca ovina*; at Assens, on *Avena*. The infected fields should be dug up and the seeds should not be sown to the above-named grasses.

***Eurydema oleracea*, Injurious to Several Plants in Sweden.** KEMNER.

GRIMM, H. *Scania. Ussaströmmen. Tidskrift*, Year XXV, Part 8, pp. 21-22, 1891, Malmö, 1-18.

Eurydema oleracea L. ("Rapsngaren") has in recent years caused a great deal of mischief in several localities in Sweden. It attacks more especially cabbages and turnips, and less frequently cereals and potatoes. On garden plants it is injurious to *Matthiola incana* and *Hebe pinnatifida*. It was considered injurious by Linnæus in 1760, but since that time it has almost entirely disappeared, and only in recent years has it begun more to breed and spread with unusual rapidity. In 1901 it was reported in 1911, at Kalmar, Scania; Söderman, in 1911, at Östergötland, Bohus, Sjöhus, Upsala, Söderman, Varml., Norrb., and Gästrikland; Kalmar, Jönköpings, Östergötland, Skåneborg, Söderman, Bohus, Varmland, and Västernorrland. It seems therefore that the climate is the conditions most favorable to it in the north. It has also been reported as injurious in Denmark and in Germany. In the adult stage it hibernates in the vegetable residues of the previous year, and in the spring it hatches. The larvae emerge in about a month, and the complete development is attained in August and September, when the most damage occurs.

Means of prevention the following are advisable:

1. In autumn remove to as great a distance from the fields as possible the leaves and refuse, etc. where *Eurydema* hibernates;
2. Use a 4% petroleum emulsion to kill the parasite in a few minutes. This must be done with care as it might hurt the more tender parts of the plants. The best results are obtained by two weak solutions applied at an interval of 3 to 10 minutes.

It is remarkable that this *Eurydema* prefers to keep to the periphery of the land in cultivation, thus the preventive measures are rendered easier.

***Leucopholis rorida* in Manioc Plantations.** LUTTMANN, S., in *Melodonta. Laboratorium für Pflanzenkrankh.*, N. 11, Fig. Buitenzorg, 1911.

About eight years ago *Manihot utilisima* began to be cultivated on the island of the Kloet in the east of Java. Shortly after a Coleopter made its appearance in the plantations and was found impossible to eradicate.

The insect was identified two years ago as *Leucopholis rorida* L. and found to be spreading rapidly. This is the most injurious of the insects attacking the roots of *Manihot utilisima*. The manioc plant grows under the most unfavourable conditions for a campaign against this insect: several reasons: the lengthy time the plant remains in the soil, the need to alternate with other crops and the superficial working of the soil. The life cycle of *Leucopholis rorida* was very carefully studied. Swarming takes place in October, November and December. The numbers then diminish. Three or four weeks later the eggs are laid at a considerable depth beneath the surface. When the larvae are about three months old damage to the plants becomes evident by the withering of the leaves, the adult larvae being at a depth of at least 10 inches it is impossible to dig the soil so as to bring them to the surface. They there pass through a period varying from one to four weeks in length and then shut themselves into a sort of cell. On emerging from this cell the insects pass through another rest period of several weeks before taking flight. One generation requires a whole year for its completion. The writer has identified a natural enemy of the larva a digger-wasp of the family *Scoliidae* sp. *Dides*. The female wasp searches in the earth for the larva and penetrates it with a sting in the oesophageal ganglion, then lays its eggs in the wound. Three or four days after, a larva hatches which attacks that of the *Leucopholis*. The time required for a generation of these wasps is from one to two months. 20 per cent of the Coleopter larvae contained these parasites. This, however, is not sufficient to destroy the pest. The natives capture the larvae by means of the crushed fruit of *Capsicum annum* L. ("Lombok") which gives out a peculiar smell; but this method has little effect and is very expensive. Other methods tried by the writer were either too expensive or too difficult to carry out.

Experiments on infecting the larva with a fungus are in course, the results that have been obtained in the laboratory appear to be satisfactory. Other trials will be made in the open. Stomach poisons cannot be used, carbon disulphide is the best material. Two doses of 20 c.c. injected into the soil at intervals of 3 ft. x 3 ft. to a depth of 10 inches seem to be sufficient. But this method is too costly to be applied on a large scale, the expense amounting to £5.12 s. per "bouw" (1 1/4 acres). Perhaps at the beginning of the infection a treatment of the infested soil with carbon disulphide might be beneficial. Other preventive measures are to dig up the soil and collecting the larvae and substituting the culture of manioc for that of manioc in the places most infected. The writer also describes the life cycle of other Coleoptera (*Lepidiola*, *Euchlora*, *Anisotoma*) which he has noticed on *Manihot*, but are not as injurious to it as *Leucopholis*.

259 - Species of *Hyponomeuta*, Injurious to *Lonicera* and *Prunus* in Sweden

— TULLGREN, ALF, in *Meddelande från Centralanstalten för växtskadestudier*, Stockholm, 1904, Entomologiska Afdelning, N. 21, pp. 1-23, Figs. 1-10. Stockholm.

Description and biological notes.

H. crenymellus L. is the species most widely distributed in Sweden.

H. malivellus has appeared in recent years on *Prunus padus* in such numbers as to cause very serious havoc. *H. malivellus* Zell., *H. patellus* L., *H. cognatellus* Hb. are more rare and never very injurious. The geographical distribution of the species reported until now, is the following:

H. cognatellus at Malmöhus, Kristianstad, Blekinge, Halland, Kalmar, Växjöborg, Skaraborg, Östergötland, Sörmland, Örebro, Stockholm, Västmanland, Bohus, Värmland, Kopparberg and Gävleborg.

H. cognatellus, in the district of Skåne, Blekinge, Västergötland, Östergötland and Uppland.

H. malivellus at Skåne and Västergötland.

H. patellus at Skåne, Blekinge, Småland and Västergötland.

Carbolineum and arsenate of lead, have given good results as preventive measures. The carbolineum is applied in the form of an 8 per cent. emulsion in the spring just before the budding begins; later, when the larvae appear, the insects are killed by spraying with a solution of arsenate of lead.

***Pulvinaria vitis* in Uruguay.** SCHIRMANN, G., in *Revista de la Agricultura Uruguaya*, Year XLIV, No. 2, pp. 171-174, 4 Fig. Montevideo, 1913.

The writer reports (it is believed for the first time) the appearance in November 1914, of *Pulvinaria vitis* ("cochinilla colorada de la uva") in Uruguay, where it causes serious damage in the vineyards. Information is given on the morphology and biology of the scale and on the means of prevention, which are similar to those already in use in other countries.

***Hylobius abietis* and Methods of Control, from Observations Made in 1913-14 in the Province of Orel, Russia.** SIMON, E. P., in *Trudy i Izvestiya Vsesoyuznogo Nauchnogo Tsentra, Seriya Biologicheskaya*, (The Soviet Review), Year XLV, Part 6-7, pp. 1050-1058, Petrograd, 1914.

Hylobius abietis is one of the insects most injurious to sylviculture. As a preventive measure, the uprooting of the stocks is advisable and gives good results in several ways, but economical reasons render it necessary to employ less expensive methods. The writer has conducted with this aim the following experiments.

On September 9th 1913, he collected from eight stocks 384 larvae of *H. abietis*, which were under the bark, above and below the collar, and partly on the roots to a depth of 14-16 inches. On the upper part of the stocks the larvae were small; those on the roots were of the largest size. On the 7th and 8th October, the researches were carried out over an area of 330 acres. In this case also the bark of the stocks and roots was barked until, on the latter, no more larvae were found. In two days the stocks were barked and 10272 larvae collected.

On the October 9th, the same work was carried out on an adjoining section of the forest; during the winter, before cutting the trees, the bark was barked from the lower part of the trunk down to the collar, so that the stocks were covered with snow through the winter and were sufficiently protected in the spring. In this section only 1239 larvae were collected, while the number of stocks was about the same as in the previous one, *i. e.* of which 98 had not been barked. While collecting the larvae it was found that they were found only on the unbarked stocks. Had the in-

sect laid its eggs with equal abundance in the two sections under examination, then, in the second section, only from the unbarked stocks, the number of larvae collected ought to have been almost double what it actually was. But it is obvious that the strong smell of the unbarked stocks in the adjoining section attracted the insects more than the 98 unbarked stocks scattered among the others that were barked and already dry.

A new means of control of *Hylobius abietis* and one easy of application is thus suggested. In the sale contracts of the pines, a clause should be included which renders obligatory the preventive barking of the trees above and below the collar before the trees are cut down. The expense is not costly, according to the data given by the writer the expense amounts to a farthing per tree, i. e. between 18, qd. and 28, 7d. per acre.

262 **The Zimmerman Pine Moth.** BRUNNER, J., in *U. S. Department of Agriculture, Bulletin No. 205*, pp. 1-17, Pl. I XI, Washington, 1915.

One of the insects of the order Lepidoptera very destructive to coniferous trees, and especially to yellow pine (*Pinus ponderosa*), in the western sections of the West, to white pine (*Pinus Strobus*), Canadian or grey (*P. resinosa*), Austrian pine (*P. aristata*), Scotch pine (*P. sylvestris*), and spruce pine (*P. Canadensis*), and other pines in the East, is the Zimmerman pine moth (*Pinipestis zimmermani* Grote). Apart from being largely responsible for the "spiketop" in mature timber, its spiketops, stunts, and kills great numbers of many trees of the so-called "second growth". It is obvious that the loss of many trees in stands preferred by the moth results in the great thinning out of the stand. This wastage of ground is further aggravated by the permanent stunting of a still greater number of trees by the work, because the space taken up by such scrubs would just as well accommodate thrifty, well-formed trees.

Moreover, the wood from trees that have been infested by the moth is invariably so permeated with pitch that the lumber cut from such trees is either materially reduced or is rendered wholly unfit for commerce.

In the northern Rocky Mountain region, *Pissodes schenckii* H. is a common associate of the pine moth in yellow pine, if the trees are cut near the base. It appears that there the moth takes as frequent advantage of the work of the beetle as the beetle does of the moth's. The result of infestation by either of them is exactly alike, although the latter's work is by no means restricted to the base of trees, while the work of the beetle is rarely found more than 2 or 3 feet above ground.

Sesiabrunneri Busck., wherever it exists (not present known in Montana and southern Idaho), is frequently associated with *Pinipestis* in yellow lodgepole pine.

In Montana and Idaho another species of *Pinipestis*, *P. canbriana* (Grote) is one of the most important factors in regard to the existence of *P. zimmermani* Grote. It infests during the latter part of June the terminal and sub-terminal branches of mature yellow pine and many of these will be subsequently reinfested by the latter year after year. The work of this insect is almost invariably the primary cause of the knobby growth of

in which the Zimmermann pine moths breed undisturbed and this may therefore be regarded as a provider of brood trees for the more active *Panipestis zimmermani*.

In most sections of the Rocky Mountains the Rocky Mountains hairy woodpecker (*Dryobates villosus monticola*) is unquestionably the most efficient force in restraining the Zimmerman pine moth. Thousands of trees each year regularly infested by the moth in comparatively recent years and this bird as regularly destroys almost all of the larvae in them during early winter.

The woodpecker cannot molest the caterpillars of the pine moth growing under "spike-tops," and in knobby branches on certain mature trees and this is evidently the reason why its activities bear no permanent

effect. The discovery of a Pimplinid of a new genus and new species is frequently made in the tunnels of the pine moth in Montana and Idaho. In some cases this parasite kills as many as 80 per cent of the larvae of the moth in growth trees. Another, somewhat larger parasite (*Ichneumon* sp.) is frequently found during winter in the chrysalids of the moth. It does not pass the winter in the pupal stage and chrysalids found in the same place always contain the parasitic fly, which, like the pimplinid, is hibernating early spring. There seems to be justification for the conclusion, without man taking a hand by eliminating the main propagating agent, no natural enemy of the moth will ever render it harmless. The "spike-topping" in mature stands, and to eliminate damage in young timber, or, at least, reduce it to a negligible amount it is necessary to remove

(1) those trees which, below the spike, show branches with yellow bark

(2) those which are struck by lightning and remain green, as the moth still breeds in great number along the lightning scars and

(3) those which display knobby growth on branches, they being in all likelihood the most prolific source of replenishment of the moth.

INJURIOUS VERTEBRATES.

Rabbits (*Lepus cuniculus*) Injurious to Forests, in Hungary. — MATSCHOVITZ, *Monatsschrift Lepus*, Year LIV, Parts XIX and XX, pp. 172-176, Budapest, 1913. During the year 1915, such an invasion of *Lepus cuniculus* occurred in the forest inspection zone of the district of Pozsony and of Nyitra, seriously threaten the forest lands and field-crops. Several proprietors therefore found it necessary to appeal to the communal authorities to take strict measures against the alarming propagation of this pest.

Rat Plagues in the Bombay Presidency. — MAIR, T. E., in *The Poona Agricultural Magazine*, Vol. VII, No. 2, pp. 77-80, Poona, 1913.

These plagues occur periodically and no part of the Presidency escapes. Perhaps the Kōkan, where the rainfall is very heavy and hinders

very effectively the multiplication and emigration of these rodents were reported for the first time in 1874, since when they have been several times, causing enormous damages. In October 1878, after the onset of the monsoon they spread rapidly over the whole Deccan and Khandesh, destroying almost entirely the crops of cotton, wheat, *jowar*, and other crops. The plague reached its maximum in 1879, when the early crops were damaged just as badly as the late ones, and the grain as soon as it was scratched up and eaten, even three times successively in many places. After destroying the winter crops the number suddenly decreased in the latter part of December and by the end of March 1880 the rats had disappeared unaccountably as they had come.

In 1892-93 a plague of rats was recorded. It originated in the talukas of Belgaum, but did not attain such serious dimensions as in 1880 owing to opportune rain and an enormous increase of red tides, which are probably one of Nature's principal controlling agencies in preventing an excessive increase of rats.

In 1901-02 rats did enormous damage in Gujarat, Khandesh and other parts of Deccan.

In 1914-15 after a heavy monsoon Khandesh crops suffered severely from rats.

The most successful methods of dealing with rat-plagues are: 1) to dig the rats out of their burrows: 2) to discharge sulphur fumes into the rat-holes by means of a flexible wire tube and pump. This latter method is the most effective.

265 - The Canadian Muskrat (*Fiber zibethicus*) in Austria. Control by Traps. — See this Bulletin, No. 218.

